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THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

XXXIX. COUNT RUMFORD'S DIETETICS.

IN the formula for Rumford's soup given in my last, it is stated that the bread should not be cooked, but added just before serving the soup. Like everything else in his practical programmes, this was prescribed with a philosophical reason. His reasoning may have been fanciful sometimes, but he never acted stupidly, as the vulgar majority of mankind usually do when they blindly follow an established custom without knowing any reason for so doing, or even attempting to discover a reason.

In his essay on "The Pleasure of Eating, and of the Means that may be Employed for Increasing it," he says:—"The pleasure enjoyed in eating depends, first, on the agreeableness of the taste of the food; and, secondly, upon its power to affect the palate. Now, there are many substances extremely cheap, by which very agreeable tastes may be given to food, particularly when the basis or nutritive substance of the food is tasteless; and the effect of any kind of palatable solid food (of meat, for instance), upon the organs of taste, may be increased, almost indefinitely, by reducing the size of the particles of such food, and causing it to act upon the palate by a larger surface. And if means be used to prevent its being swallowed too soon, which may easily be done by mixing it with some hard and tasteless substance, such as crumbs of bread rendered hard by toasting, or anything else of that kind, by which a long mastication is rendered necessary, the enjoyment of eating may be greatly increased and prolonged." He adds that "the idea of occupying a person a great while, and affording him much pleasure at the same time in eating a small quantity of food, may, perhaps, appear ridiculous to some; but those who consider the matter attentively will perceive that it is very important. It is perhaps as much so as anything that can employ the attention of the philosopher."

Further on he adds:—"If a glutton can be made to gormandise two hours upon two ounces of meat, it is certainly much better for him than to give himself an indigestion by eating two pounds in the same time."

This is amusing as well as instructive, so also are his researches into what I may venture to describe as the *specific sapidity* of different kinds of food, which he determined by diluting or intermixing them with insipid materials, and thereby ascertaining the amount of surface over which they might be spread before their particular flavour disappeared. He concluded that a red-herring has the highest specific sapidity, *i.e*, the greatest amount of agreeable flavour in a given weight of any kind of food he had tested, and that, comparing it on the basis of cost for cost, its superiority is still greater.

He tells us that "the pleasure of eating depends very much indeed upon the *manner* in which the food is applied to the organs of taste," and that he considers "it necessary to mention, and even to illustrate in the clearest manner, every circumstance which appears to have influence in producing these important effects." As an example of this, I may quote his instructions for eating hasty pudding:—"The pudding is then eaten with a spoon, each spoonful of it being dipt into the sauce before it is carried to the mouth, care being had in taking it up, to begin on the outside, or near the brim of the plate, and to approach the centre by regular advances, in order not to demolish too soon the excavation which forms the reservoir for the sauce." His solid Indian corn pudding is, in like manner, "to be eaten with a knife and fork, beginning at the circumference of the slice, and approaching regularly towards the centre, each piece of pudding being taken up with the fork, and dipped into the butter, or dipped into it *in part only*, before it is carried to the mouth."

As a supplement to the cheap soup receipts given in my last, I will quote one which Rumford gives as the cheapest food which in his opinion can be provided in England:—Take of water eight gallons, mix it with 5 lb. of barley-meal, boil it to the consistency of a thick jelly. Season with salt, vinegar, pepper, sweet herbs, and four red herrings pounded in a mortar. Instead of bread, add 5 lb. of Indian corn made into a *samp*, and stir it together with a ladle. Serve immediately in portions of 20 ounces.

Samp is "said to have been invented by the savages of North America, who have no corn-mills." It is Indian corn deprived of its external coat by soaking it ten or twelve hours in a lixovium of water and wood ashes.* This coat or husk, being separated from the kernel, rises to the surface of the water, while the grain remains at the bottom. This separated kernel is stewed for about two days in a kettle of water placed near the fire. "When sufficiently cooked, the kernels will be found to be swelled to a great size and burst open, and this food, which is uncommonly sweet and nourishing, may be used in a great variety of ways; but the best way of using it is to mix it with milk, and with soups and broths as a substitute for bread." He prefers it to bread because "it requires more mastication, and consequently tends more to prolong the pleasure of eating."

The cost of this soup he estimates as follows:—

	d.
5 lb. barley-meal, at 1½d. per lb., or 5s. 6d. per bushel	7½
5 lb. Indian corn, at 1¼d. per lb.	6¼
4 red herrings	3
Vinegar	1
Salt	1
Pepper and sweet herbs	2
	1/8¾

This makes 64 portions, which thus cost rather less than one-third of a penny each. As prices were higher then than

* Such lixovium is essentially a dilute solution of carbonate of potash in very crude form, not conveniently obtained by burners of pit coal. I will try the commercial carbonate, and report results in my next, stating quantities and other particulars. I have but just come upon this particular soup receipt for the first time.

now, it comes down to little more than one farthing, or one-third of a penny, as stated, when cost of preparation in making on a large scale is included. I have not yet tried this soup. In reference to the others specified in my last, I should add that I found it advantageous to use a double vessel—a water-bath constructed on the glue-pot principle. Such vessels are sold under the name of "milk-scalders."

The reason of this is, that with our ordinary fireplaces the heat is so great that the liability to char the bottom of the thick porridge is a source of trouble. Rumford's fireplaces were so skilfully constructed, and used with just as much wood fuel as was required to do the work demanded, and thus this difficulty scarcely existed. I have little doubt that one of the reasons why the thin broth of our workhouses and prisons takes the place of his thick soup is, that the liquid stuff demands no skill nor attention from the officials who superintend and the cooks who prepare it. Their convenience is, of course, sacred.

The feeding of the Bavarian soldiers is stated in detail in Vol. I. of "Rumford's Essays." Space will permit me only to take one example, and that I must condense. It is from an official report on experiments made "in obedience to the orders of Lieut.-General Count Rumford, by Sergeant Wickelhof's mess, in the first company of the first (or Elector's own) regiment of Grenadiers at Munich."

June 10, 1795.—Bill of Fare.

Boiled beef, with soup and bread dumplings.

Details of the Expense.

First for the boiled beef and the soup.

lb.	loths.		Creutzers.
2	0	beef	16
0	1	sweet herbs	1
0	0¼	pepper	0½
0	6	salt	0½
1	14½	ammunition bread cut fine	2⅔
9	20	water	0
Total... 13	10	Cost ...	20⅔

The Bavarian pound is a little less than 1¼ lb. avoirdupois, and is divided into 32 loths.

All these were put into an earthenware pot and boiled for two hours and a quarter; then divided into twelve portions of 26$\frac{7}{12}$ loths each, costing 1¾ creutzer.

Second for the bread dumpling.

lb.	loths.		Creutzers.
1	13	of fine Semel bread	10
1	0	of fine flour	4⅓
0	6	salt	0½
3	0	water	0
Total... 5	19	Cost...	15

This mass was made into dumplings, which were boiled half an hour in clear water. Upon taking them out of the water they were found to weigh 5 lb. 24 loths, giving 15⅓ loths to each portion, costing 1¼ creutzer.

The meat, soup, and dumplings were served all at once, in the same dish, and were all eaten together at dinner. Each member of the mess was also supplied with 10 loths of rye bread, which cost $\frac{5}{16}$ of a creutzer. Also with 10 loths of the same for breakfast, another piece of same weight in the afternoon, and another for his supper.

A detailed analysis of this is given, the sum total of which shows that each man received in avoirdupois weight daily:

lb.	oz.	
2	$2\frac{14}{100}$	of solids
1	$2\frac{84}{100}$	of "prepared water"
3	$5\frac{10}{100}$	total solids and fluids.

which cost 5$\frac{17}{45}$ creutzers, or twopence sterling, very nearly.

Other bills of fares of other messes, officially reported, give about the same. This is exclusive of the cost of fuel, &c., for cooking.

All who are concerned in soup-kitchens or other economic dietaries should carefully study the details supplied in these essays of Count Rumford; they are thoroughly practical, and, although nearly a century old, are highly instructive at the present day. With their aid large basins of good, nutritious soup might be supplied at one penny per basin, leaving a profit for establishment expenses; and if such were obtainable at Billingsgate, Smithfield, Leadenhall, Covent-garden, and other markets in London and the provinces, where poor men are working at early hours and cold mornings, the dram-drinking which prevails so fatally in such places would be more effectually superseded than by any temperance missions which are limited to mere talking. Such soup is incomparably better than tea or coffee. It should be included in the bill of fare of all the coffee-palaces and such like establishments.

THE TRANSMISSION OF POWER.

By A. Beringer.

If we admit that the local conditions are equally favourable to the four systems (viz, electricity, water under pressure, compressed air and telo-dynamic cables), that is to say, if we set on one side particular considerations which may render one or the other system more suitable in a given case, the comparison of prices shows that electricity and telo-dynamic cables are the most favourable agents for the transmission of power. Between these two we must choose the cable as effecting the cheap transmission up to a distance of 1 kilomètre, but for greater distances electricity is preferable.

We note, in passing, the interesting result that a hydraulic motive power transmitted by electricity to a distance of 20 kilomètres costs less than the same power produced on the spot by a large improved steam-engine, even if we calculate the water-power at 0·03 fr. per horse-power daily. It follows that a powerful waterfall will supply, within a radius of four leagues, power cheaper than that produced by steam-engines of 100 to 200 horse-power, and within a far wider radius it will compete advantageously with small steam-engines or with gas.

Although cables are very suitable for distributing power in the country to a few separate places, they are quite out of the question when it is required to effect unlimited subdivisions, *e.g.*, in a distribution of power from house to house in a town. In this case the three other systems remain alone in the field.

For instance, if less than 1 kilomètre electricity has only the advantage of a few centimes over air and water, but its advantage increases for longer distances. Thus the hourly cost per horse-power for ½ kilomètre is 0·24 franc, for 1 kilomètre 0·25 franc, and for 12 kilomètres 0·37 franc, whilst water and air reach this price for 1½ to 2 kilomètres.

Transmissions by water and air are therefore far surpassed by electric transmission, and if we wish to produce power by steam in a central establishment and distribute it from house to house within a radius of 10 kilomètres electricity alone could furnish an economical solution of the problem.

We must here remark that such a distribution of power can only be, for the present, useful in the small trades, for if more than 10 horse-power is required, a special motor is more advantageous.

If we divide the region to be supplied with power into

squares of 8 to 10 kilomètres a-side, having each a large steam-motor, we may supply a horse-power at 0·25 franc hourly as against 0·32 franc, which would be the cost of a gas-motor, showing a considerable economy in favour of electricity.

There are numerous cases where local conditions render it impossible to set up a motor at the place where the power is required, and only certain systems of transmission can here be employed. Thus in mining and tunnelling, air and electricity only are applicable, and if we suppose that there is need for 10 horse-power, we see, on comparing the price of this power transmitted by compressed air and by electricity, that the advantage is greatly in favour of the latter. For more considerable transmissions of power the prices agree fairly well up to 5 kilomètres, but beyond this the advantage of electricity becomes very decided. In addition, an electric transmission is more easily established than the conduction of compressed air, and it is much easier to extend a system of the first kind than of the second.

Certain boring-machines with compressed air often suffice for ventilation, whilst an electric transmission of power requires to be accompanied by especial appliances for this purpose. Still the advantages of electricity as regards convenience and economy are so great that we cannot hesitate to employ it whenever there is no fear that sparks from the dynamo machines may occasion explosions, especially as electricity can at the same time serve for lighting.

In conclusion, in cases where telo-dynamic cables are not applicable, electric transmission is much preferable to transmission by water or compressed air. It is more economical than gas-motors for transmissions up to 5 kilomètres. Where transmission by cable is applicable it is more economical up to 1 kilomètre. From 1 to 5 kilomètres electricity has the advantage.—*Revue des Mines.*

THE ENTOMOLOGY OF A POND.

By E. A. Butler.

THE MIDDLE DEPTHS (*continued*).

PASSING on now to the stouter-bodied, shorter-horned flies, our only example will be the insect called *Stratiomys chameleon*, the common chameleon fly, which belongs to a family containing several aquatic representatives. It is a broad, flat-bodied insect (Fig. 1), with a

Fig. 1.—Chameleon Fly.

velvety black body, adorned with yellow markings, and is a near relation of those lovely, glossy, metallic-looking flies, with long, dark wings, and bodies of a greenish, purplish, golden, brassy, or bronzy tint, that are often seen sucking the honey of flowers in damp places, or sunning themselves, and displaying their beauty on the leaves of trees. The eggs are not launched in rafts, like those of gnats, but laid in overlapping rows, like roofing slates, on the underside of the broad leaves of the water plantain, *Alisma plantago.* The larva, which is of an elongate form, tapering greatly towards the tail, is chiefly remarkable for the perfect star of about thirty feathery hairs it carries at that extremity. As usual, this circlet of hairs is intended to assist in the respiratory function. To breathe, the insect slowly rises to the surface by serpentine wriglings, and remains suspended there, the coronal hairs acting as a float, and by their capillary attraction causing the water to recede from the respiratory orifice which is situated in their centre, so that air can be taken in at pleasure. When this has been effected, the insect closes its hair star somewhat as one would shut an umbrella, and slowly descends to the depths again, carrying with it the spoils of the outer world in the form of a silvery globule of air entangled in its plume. Its jaws and other appendages of the head are in constant motion, creating currents which bring to it the minute creatures on which it feeds. During larvahood, then, it does not very greatly depart from the general style and method of life of the gnats and other long-horned flies, but when we come to the next stage we notice a great difference. Hitherto we have found the pupa shaped like a large comma, and breathing by appendages attached to the thoracic region. In the chameleon fly, however, a totally different arrangement is made. The true pupa is formed within the old larva skin, which retains its form so that but little change, except an inflexibility of body, is apparent outwardly. The pupa itself, however, reveals all the organs of the future insect, and with its wings and legs folded lengthwise along its breast looks like a miniature Egyptian mummy. It is much smaller than the larva, and so does not occupy nearly the whole of the space the old skin affords, the long tail-like part being converted into an air-chamber to supply with aërial nutriment the imprisoned mummy, which has its spiracles situated in the usual position down the sides. When the time for emergence arrives, a portion of the case near the head is removed, and the fly makes its exit through the opening.

There is a small family of moths whose caterpillars are aquatic, and may be found feeding on plants below the surface; but we will reserve a notice of these till we treat of the perfect insects, which are abundant amongst the rank vegetation fringing the edges of the pond.

Besides the bugs, beetles, and fly larvæ, which are the legitimate inhabitants of this part of our pond, certain perfect insects belonging to orders that one would assuredly not expect to find represented in the water—at least in the adult state—may occasionally be detected paying flying visits to these regions. About twenty years ago, Sir John Lubbock discovered that some minute insects allied to the ichneumon flies, and therefore belonging to the order Hymenoptera, are aquatic in habits. This was a most surprising discovery, for though the Hymenoptera form an enormously large order, the number of species having been estimated even at 30,000, not a single member of this vast host had previously been known to have any connection with water. Sir John Lubbock describes the discovery as follows:—"Great was my astonishment . . . when I saw in the water a small Hymenopterous insect, evidently quite at its ease, and actually *swimming* by means of its wings. At first I could hardly believe my eyes, but having found several specimens, and shown them to some of my friends, there can be no doubt about the fact. Moreover, the same insect was again observed, *within a week*, by another entomologist, Mr. Duchess, of Stepney . . . . It is a very curious coincidence that, after remaining so long unnoticed, this little insect should thus be found almost simultaneously by two independent observers." Twenty-one specimens in all were seen, and two-thirds of these

were females. The tiny being (Fig. 2) measures no more than $\frac{1}{25}$ of an inch in length. It has no nervures in its wings, the hinder pair of which are so narrow as to be scarcely more than linear in shape, and both pairs are fringed round the edges with hairs. It belongs to a group which, like the ichneumon flies, are parasitic

Fig. 2.—Polynema natans.

upon other insects, but many of the smaller species attack their hosts, not when the latter are in the larval condition, but actually while they are in the egg, the contents of a single egg being sufficient to furnish nutriment to the grub of the parasite during the whole of its brief larval career, and sometimes even one egg is the home of several parasites. The present insect, which was named by Sir John Lubbock *Polynema natans*, may, therefore, with much probability be presumed to have been in quest of the larva or eggs of some aquatic creature in which to deposit its own brood. It would seem, however, that this can hardly be the sole cause of the entry of these insects into the water, inasmuch as the males were found swimming as well as the females. The wings did not seem particularly effective as swimming organs, the progress of the insects being but slow, and in a series of jerks; sometimes, too, the swimming was abandoned in favour of crawling over the aquatic plants. Marvellous as it may seem that a creature should use as swimming-organs delicate membranous wings, apparently adapted only for aërial flight, the marvel becomes greater when it is remembered that the little diver is not in any way structurally adapted for an aquatic life, except it be by the fringes round the wings, but these it has in common with other members of the same group which never enter the water at all. There is no flattening of the legs, no tapering of the form in front, no arrangement to provide for subaqueous respiration. The breathing is conducted in the ordinary way by means of spiracles, and all the time the insect is under water, it has, so to speak, to hold its breath, just as one of the higher animals would have to do under similar circumstances. At first thought it would seem, therefore, that the tiny creature, in obeying its maternal instincts, incurs some risk of drowning, but it must be remembered that insects do not require a renewal of air anything like so frequently as the higher animals, and in the present instance the power of endurance seems to be much greater even than usual. Sir John Lubbock found that one of his insects could endure submersion for twelve hours without inconvenience, but that after fourteen hours it was to all appearance dead; however, on being transferred to a dry spot, it revived, and, after a time, became as lively as ever, so much so, in fact, that, notwithstanding its uncomfortable experience of temporary drowning, it did not hesitate, when an opportunity was again afforded, again to enter the water. Professor Westwood has suggested, however, in explanation of this power of enduring prolonged submersion, that the fringe round the wings may carry down entangled in its hairs a small quantity of air, sufficient for the wants of the insect during the time it would naturally remain below.

Curiously enough, a second aquatic species, a trifle larger than the other, and much less common, was discovered on the same occasion and by the same observer. It swam, however, not by aid of its wings, which were kept still, but by a rowing motion of the legs, and thus progressed more rapidly than its relative.

Ichneumon flies have recently been bred from the pupæ of a Gyrinus, or whirligig beetle, which, as will be remembered, is, in its larval state, subaqueous. It is not known, however, at what period in the history of the Gyrinus the ichneumon eggs are inserted in the body of the host, though, judging from analogy, it would seem probable that it is the larva that is thus victimised, and in that case either the ichneumon must dive, or the larva must be attacked during its temporary exposure on the aquatic plant on which it forms its cocoon; still, however, the eggs may be deposited in the pupa through the walls of the cocoon, the ichneumons possessing ovipositors long and powerful enough for the purpose.

Certain caddis flies, or water moths as they are sometimes called, and dragon flies have also been known voluntarily to submerge themselves in order to deposit their eggs in appropriate positions.

(To be continued.)

RAILWAY BRAKES.

By "Trevitheck."

During the past few years, a prolonged and, at times, an acrimonious discussion has been carried on concerning the advantages and disadvantages of brakes as applied to railway engines, carriages, and trucks. The speed of travelling is now on the average very high, the trains run in rapid succession, and the lines are gradually being called upon to work to the full extent of their capacity. All this means that if the work is to be got through with anything like efficiency, every possible chance of facilitating the traffic should be taken advantage of. Englishmen are, however, more phlegmatic and more inclined to repose implicit faith in the powers that be than they imagine, or would grant to be possible. It is, indeed, a stern reality, that it requires a great calamity to awaken them to the fact that one of man's first duties of citizenship is to see that what is done around him is the best that can be effected for his own comfort and for that of his fellow-creatures.

Such an awakening has been lately experienced, for during the past few weeks, embracing the longest days of the year, at a season when fogs have no place in our weather "forecasts" or "reviews," we have had our eyes rudely opened to the fact that the railway system of England is one that revels in disaster, torture, and death. Now it must be patent to the most superficial thinker that, if our climatic conditions are such as to preclude the jury from attributing a disaster, as they did the one near Oxford a few years back, to a "freak of nature," such disaster must be due to some cause in the main preventible. Be it observed, further, that the accidents now providing detailed horrors for the daily papers, happen for the most part in the full blaze of the sun, with a good road beneath, a good sky above, and a good light in front. Hundreds of trains seem to carry with them day by day and hour by hour a sure and effectual means for securing their

own destruction, together with that of those persons being transferred from place to place. In the early days of railway travelling, when trains were few and far between, and when the pace was generally slower, the old-fashioned hand-brake applied by the guards to their own carriages were just good enough to be tolerated, but at the present day, when so many improved forms are on the market, it can only be regarded as little short of a crime to despatch a train upon its perilous journey bereft of what should be, in reality, its greatest safeguard. It requires but little argument to demonstrate that a brake, capable of being applied to only one or two carriages in a more or less lengthy train, may, at times, prove even worse than useless, for it begets in the minds of those in charge a false sense of security. And what I have just said may be even more strongly emphasized when we consider the condition of a train supplied with a continuous brake which can only be of use when every portion of it is in good order. That the recent catastrophe at Penistone may be ascribed to a state of things not far removed from the one depicted is, I fear, only too probable. Of this, however, I shall be at liberty to speak more fully later on. Suffice it for the present to say that in this particular case the engine was not pulled up by the brake, but went on for 570 yards from the spot where the axle of the engine broke, while the carriages from which it parted company only proceeded about half the distance mentioned, the wheels running on the track, and the rails being broken and torn up. There is every reason to believe that the brake which was in this case applied by the driver failed almost immediately, and may, therefore, so far as its effect is concerned, be regarded as having proved worse than useless. The Downton accident, on the South-Western Railway, was another of a somewhat similar character. The only important difference between them was in the loss of life and limb caused. The Wiltshire accident might have been averted had proper brake power been applied to the whole train instead of an imperfect one to a fraction of it. There a rupture in the connections permitted the carriages to obey one of Nature's first laws, and, instead of following the engine round the curve, they forsook the rails, and rushed down an embankment into a river. At Penistone the carriages ran down an embankment into a road below.

Accidents such as these carry with them great and practical lessons, which it behoves each one of us to bear in mind. It is more than proved that one of the essentials to safe travelling is that every train should be fitted with an efficient brake—nay, more than this, it is necessary that every individual carriage should be furnished with a means for arresting its own progress in the event of its being severed from the rest of the train.

There are at the present moment several forms of continuous brakes in use—brakes, that is, which are fitted and applied to each vehicle, and one great distinction is that while some of them are capable of performing their allotted task automatically, others only respond to the manipulation of those in charge. These two classes may be typically represented by the Westinghouse and the Smith brakes respectively. And perhaps the respective merits of the two could not be illustrated more forcibly than by quoting their behaviour from the chapter of accidents in July. On the 8th a Great Eastern express *en route* for Doncaster met with an accident. When nearing Spalding Station the axle of the driving-wheels broke. The train was instantly stopped by the application of the Westinghouse brake, and, a fresh engine having been procured, the train proceeded, after half-an-hour's delay. "Had," points out our contemporary *Engineering*, "a similar brake been in use at Penistone, it could have been at once brought into action by the parting of the train, even if it had not been applied earlier; and there are the best grounds for believing that twenty-three lives and much dreadful injury might have been saved." To quote another case, which might have ended in a most dreadful catastrophe:—

"In reply to inquiries respecting the details of an accident which lately took place near Chicago, Mr. Joseph Wood, the Superintendent, said:—'The train consisted of an engine, one baggage and three sleeping-cars, weighing about 190 tons. At the time of the accident, the train was on a descending gradient of 1 in 125, and was going at a speed of from 40 to 45 miles per hour. After leaving the rails, the engine went partly down an embankment, taking with it the baggage and the first sleeping-car, and stopping at a point 240 ft. from the point of derailment; the other two sleeping-cars remained on the road-bed; the rear end of the rear car being 75 feet ahead of the point of derailment, showing that from the time of the application of the brakes (when the engine was derailed and broken loose from the tender) to the point of stopping of these cars, they had gone a distance of 370 feet. These facts so strongly emphasise the efficiency of the brake, that further words seem unnecessary. I may add, however, that none of the passengers were injured sufficiently to delay their journey.'"

Such is the behaviour of the Westinghouse brake. The Smith non-automatic brake, on the other hand (the type employed on the Manchester, Sheffield, and Lincolnshire Railway), can only act so long as the various parts of the train remain coupled together, and the whole of the brake apparatus intact. It is controlled from the engine, and anything going wrong with the train, and causing a separation, the brakes become useless, for even if they are applied prior to the severance, they "proceed immediately to come off by themselves." A train equipped with such a "continuous" brake as this, is, under such circumstances, quite as helpless as was the South-Western train at Downton, which, as stated above, was without a continuous brake.

There is another class or, rather, a sub-class of brakes, which, while they respond very well at times, are unreliable if called upon with any degree of frequency. Such a brake is that known as the Clayton, and the use of which almost resulted in a disaster that would have resembled very closely the Downton affair. On the 12th of last month a Midland train, consisting of fourteen vehicles, came into violent collison with the buffer stops at Swansea. The passengers who were preparing to alight were thrown together and much shaken, fifteen of them being also cut about the face and head. A doctor was on the spot and promptly attended to the injured. The train was fitted with the "leak off" Clayton automatic vacuum brake, and the driver had applied it to stop about a quarter of a mile from the terminus, on account of the signals being against him. The line was cleared at once, and on again applying his brake to stop at the platform, the unfortunate driver found himself without brake power, and was unable to avoid the collision. This is by no means the first time such an incident has occurred in connection with this brake, and the accident (!) at Portskewet, Northampton, Liverpool, and Bradford, from the same cause, should have made it perfectly clear that this brake is not to be trusted for a second or third application.

The different forms of brake thus briefly referred to it is my purpose to describe more in detail hereafter. There is, however, one point that may be urged. One of the greatest objections to the uniform adoption of a good automatic brake is the expense. Such a contention is, however, more than answered by a report recently made by Mr. T. E. Harrison, Chief Engineer of the North-Eastern Railway.

XUM

A detailed statement of the cost of maintaining the Westinghouse brake on 2,666 vehicles for two years is given, and this is particularly instructive. From it we find that, including the cost of replacing the whole of this stock with new hose pipes, for reasons explained in the report, the total expenditure for maintaining both the brake proper and the brake rigging, exclusive of brake blocks, is under 9s. 6d. per vehicle per annum. As Mr. Harrison points out, however, the cost for hose pipes should be reduced by one-half to get an average, which brings the sum to only 7s. per vehicle. This amount includes everything but brake blocks, which are common to all brakes, and is made up as follows:—Maintaining and repairing parts of brake and rigging, 8d. per vehicle per annum; hose renewals, 2s. 4d. per vehicle per annum; men's wages, testing and overhauling, and inspectors' salaries, 4s.; total, 7s. This sum is equal to about $1\frac{1}{4}$ per cent. for the first cost of the brake proper and the brake rigging—a truly surprising result, which, as the report says, "shows conclusively that there is great economy in the maintenance of the Westinghouse brake."

Surely this, from so great an authority, should suffice to convince any one; but the question, viewed from a public standpoint is not, except to a very small extent, one of expense. If railway directors are determined to remain admirers of such appliances as the vacuum non-automatic brake because of their "simplicity and beauty," they must be convinced of the paramount necessity of ensuring, as far as possible, the safety of their customers. There is a Board of Trade requirement concerning brakes which, however, is not followed out, and signs are not wanting of an urgent appeal being made to Parliament to enforce compliance; but I take it that travellers have the question, to a great extent, in their own hands, and can call for reform with a voice more potent even than that of Parliament, by taking such alternative routes to their various destinations as will enable them to repose confidence in the appliances introduced for their security.

Speaking of the efficiency of the Westinghouse brake, Mr. Harrison, in the report above referred to, points out that the great object of the introduction of continuous brakes was not for the mere stopping of trains at stations, but that it might be used as an emergency brake to prevent accidents, and every day's experience shows more clearly the efficiency of this brake for this purpose and in diminishing the extent of damage when accidents do occur, and it is generally liked by all engine drivers who have used it. It has been found especially useful for working steep inclines, of which there are many on the North-Eastern system, in some the gradients being as steep as 1 in 37.

THE INTERNATIONAL HEALTH EXHIBITION.

X.—WATER AND WATER-SUPPLIES—(*continued*).

II. Artificial Waters necessarily include samples of the most varied characters. For the sake of convenience, we shall here group together those which are purposely prepared by man to meet certain ends, and others which result indirectly through the agency of living beings. To the former class distilled and aërated waters belong, to the latter, plant-waters and sewage.

1. *Distilled Water* may be prepared from any of the numerous varieties which we have already considered. The process is conducted in an apparatus called a still which consists of a suitable boiler of metal, glass, or stoneware, to the summit of which a pipe is fixed for the purpose of conveying away the steam or vapour produced by the boiling of the water into a condenser. The form of condensor usually adopted is a coiled tube immersed in a vessel of water, which is kept cold by a continuous current from a cistern. The steam on passing through the condenser becomes reconverted into water, and the liquid so produced is practically pure water, freed from most of its gaseous, and all its solid, impurities.

The "foreshot" of the distillate should be rejected, as it is liable to contain gases, organic matters, acids, and ammonia, which obtain in the original water. In like manner, the process should be discontinued before the still has been exhausted, in order to reduce the possibility of a passage over of residual products. Distilled water thus prepared is particularly greedy of dissolvable substances, and will even attack matters which natural waters would leave unaffected. Its preparation in vessels with pipes of metal, more especially of lead, and its storage in leaden receptacles, should be avoided, to prevent a chance of poisonous contamination. We would, therefore, once more direct the attention of our readers to Messrs. Doulton & Co.'s exhibit, where they may view with satisfaction the admirable utilisation of stoneware for chemical apparatus.

2. *Aërated Waters* are only manufactured for beverages; they do not come within the scope of our present inquiry; but, as we have already dealt with some of the more important aspects of this question, we would now redirect our readers to what we have stated with regard to the preparation of such drinks from a sanitary point of view, and to Messrs. Barnett & Foster's stand in the Western Gallery of the Exhibition.

3. *Plant Waters.*—In tropical forests, many plants have the power of collecting and storing water in their tissues, which is often a boon to the parched explorer. The well-known Traveller's Tree affords copious draughts of cool fresh water on being pierced.* The grateful juice of the Cocoanut palm fruit affords a beverage which in quantity is sufficient to allay thirst, and, in palatable quality, excels the most delicious of artificial drinks. The cut inflorescences, in their estivation, of both the Cocoanut and the graceful Palmira, yield a delightfully refreshing nectar, which, however, is prone to ferment very speedily, and is then commonly called "toddy" by the natives of India. All these waters are of the nature of elaborated saps, but yet from their abundance in regions where water is scarce or polluted, are of sufficient importance to demand some attention here. Other plants with succulent stems, leaves, fruits, &c., are not to be classed with the above, since they are incapable of satisfying thirst, and moreover, their very existence presupposes an ample supply of wholesome water.

4. *Sewage* may be defined as the concentrated refuse of communities of human beings. In towns such as Manchester, where excrementitious waste products are utilised, and are not permitted to enter the drains, sewage is comparatively harmless; but in districts like London, in spite of every care, the pollution of rivers from such sources often assumes a most dangerous aspect. Royal Commissions, Metropolitan Boards, and Houses of Parliament all seem to be ineffectual to cope with impending evils; the first points

* The munificent gift of Miss North to Kew Gardens contains a series of beautiful paintings of tropical plants. Amongst the most noteworthy is the Traveller's Tree (*Ravenala Madagascariensis*), a striking example of the Banana tribe (*Musaceæ*). It may here be observed that the large expanded leaves, with their grooved midribs, afford channels for conveying the rain-water to sheathed recesses at their bases. The water thus collected remains fresh and limpid, and may be obtained by piercing through the attached ends of the soft, loosely-textured petioles.

out the dangerous ground, whilst the two last-named bodies remain inert, or, at least, expend an enormous sum of money per day on chloride of lime.* In the meantime Dr. Koch's comma-like cholera germ awaits but an opportunity for establishing itself in our midst. We cannot refrain from expressing our opinion that it is "passing strange" that all this misdirected expensive energy should exist, when numerous well-devised, inexpensive, nay *profitable* methods, for counteracting all ill-effects are easily available. It shall be our duty in future pages to give a detailed account of some of these.

We have already said enough about germs and their agency in producing chemical poisons or ferments, and upon decaying animal and vegetable structures in water to seriously alarm the more apprehensive of our readers. It is best, however, "to err on the side of safety," but we most emphatically disagree with "W. C. B.'s" address to our editorial fountain-head, which we requote here as an extraordinary sanitary curiosity :—

"W. C. B." demurs to the idea that a polluted river is necessarily unwholesome, as over and on the banks of one—"a mass of festering filth, chocolate in colour, molasses in consistency, and of stench simply indescribable"—many of his workpeople live, hale and hearty, as did he and a large family for fifteen years. Moreover, twenty cows, always well and thriving, drink this filth in preference to pure spring water.

To which our "E. F." aforesaid curtly replies :—"Just so; *de gustibus non est disputandum!*" † which, being freely translated, would sound very like the olden English saying, "There 's no accounting for tastes, as the old woman said when she kissed her cow."

Nevertheless, organically polluted waters, of which sewage is a type, do undergo a process of natural purification. The organic matter consists chiefly of azotised substances and hydrocarbons; and the water, in its passage along rivers or through the soil, takes up a large proportion of oxygen, which in its turn reacts upon the former, converting them into useful nitrates; and upon the latter, causing them to give forth the equally valuable carbonic acid gas. But these processes are necessarily tardy, and, in the majority of cases, but imperfectly carried out. The water of rivers containing sewage is, moreover, not only prone to be temporarily unsuitable for domestic purposes, but it contains in addition chemical poisons, which result from the fermentative action of putrefactive agents, which no process of oxidation can ever eradicate. Whether these ferments are generated in sufficient quantity to render certain streams and rivers detrimental to the life of plants and fish, yet remains to be investigated; but we may safely argue from premises such as the above, that a prolonged discharge of sewage into rivers clearly points to a termination which must inevitably be disastrous to both plant and animal life.

We shall hereafter pass on to consider in detail the varieties of water suitable for specific purposes, the tests to be used in the determination of their respective values, and the means which have been adopted by recent inventors to meet all demands.

A Simple Sunshine Recorder.—Professor Herbert Macleod, of Cooper's Hill Engineering College, has devised a simple and effective sunshine recorder by merely placing a globular bottle of water (or water lens) in front of the lens of a camera in such a position that the focussed ray falls on a sheet of sensitised paper spread on the bottom of the camera box. A curved white line or band is produced on the paper as the sun revolves, and when clouds cross the sun the line stops.—*Engineering.* [I have often wondered that some such simple contrivance has not been devised before. The price at which so-called "sunshine-recorders" are sold is exorbitant. —Ed.]

* Cf. *Daily Telegraph*, July 16, 1884. † "Ut Supra," page 61.

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

(*Continued from p.* 70.)

"WHEN they had ranked the heavens in the manner you tell me, pray what is the next question?" "The next," said I, "is the disposing the several parts of the universe, which the learned call making a system; but before I expound the first system, I would have you observe, we are all naturally like that madman at Athens,* who fancied all the ships were his that came into the Pyræum port. Nor is our folly less extravagant; we believe all things in nature designed for our use; and do but ask a philosopher, to what purpose there is that prodigious company of fixed stars, when a far less number would perform the service they do us? he answers coldly, they were made to please our sight. Upon this principle, they imagined the earth rested in the centre of the universe, while all the celestial bodies (which were made for it) took the pains to turn round to give light to it. They placed the moon above the earth, Mercury above the moon, after Venus the sun, Mars, Jupiter, Saturn; above all these they set the heaven of fixed stars, the earth was just in the middle of those circles which contain the planets; and the greater the circles were, they were the farther distant from the earth, and by consequence the farthest planets took up the most time in finishing their course, which in effect is true."

"But why," said the Marchioness, interrupting me, "do you dislike this system? It seems to me very clear and intelligible."

"However, Madam," said I, "I will make it plainer; for should I give it you as it came from Ptolemy its author, or some others who have since studied it, I should fright you, I fancy, instead of diverting you. Since the motions of the planets are not so regular, but that sometimes they go faster, sometimes slower, sometimes are nearer the earth, and sometimes farther from it;† the antients invented I know not how many orbs or circles involv'd one within another, which they thought would solve all objections: This confusion of circles was so great, that at that time, when they knew no better, a certain King of Castile, a great mathematician, but not much troubled with religion, said, 'That had God consulted him when he made the world, he would have told him how to have framed it better.' The saying was very atheistical, and no doubt the instructions he would have given the Almighty, was the suppressing those circles with which he had clogg'd the celestial motions, and the taking away two or three superfluous heavens which were plac'd above the fixed stars: for the philosophers, to explain the motion of the celestial bodies, had above the uppermost heaven (which we see) found another of crystal, to influence and give motion to the inferior heavens; and where-ever they heard of another motion, they presently clapp'd up a crystal heaven, which cost 'em nothing."

"But why must their heaven be of crystal," said the Marchioness; "would nothing else serve as well?"

"No, no," replied I, "nothing so well; for the light was to come thro' them, and yet they were to be solid. Aristotle

* The reasoning here closely resembles that which the modern student of the subject has to employ.—R. P.

† Sometimes advance and sometimes retrograde, he should have added.—R. P.

would have it so, he had found solidity to be one of their excellencies; and when he had once said it, no body would be so rude as to question it. But it seems there were comets much higher than the Philosophers expected, which, as they pass'd along, broke the crystal heavens, and confounded the universe: But to make the best of a bad market, they presently melted down their broken glass, and to Aristotle's confusion, made the heavens fluid; and by the observations of these latter ages it is now out of doubt, that Venus and Mercury turn round the sun, and not round the earth, according to the antient system, which is now every where exploded, and all the *ipse dixits* not worth a rush. But that which I am going to lay down, will solve all, and is so clear, that the King of Castile himself may spare his advice."

"Methinks," says the Marchioness, "your philosophy is a kind of outcry, where he that offers to do the work cheapest carries it from all the rest."

"'Tis very true," said I, "Nature is a great housewife; she always makes use of what costs least, let the difference be ever so inconsiderable; and yet this frugality is accompanied with an extraordinary magnificence, which shines through all her works—that is, she is magnificent in the design but frugal in the execution, and what can be more praiseworthy than a great design accomplished with a little expense? But in our ideas we turn things topsy-turvy, we place our thrift in the design, and are at ten times more charge in workmanship than it requires, which is very ridiculous."

"Imitate Nature, then," said she, "in your system, and give me as little trouble as you can to comprehend you."

"Fear it not, madam," said I, "we have done with our impertinences. Imagine, then, a German called Copernicus confounding everything, tearing in pieces the beloved circles of antiquity, and shattering their crystal heavens like so many glass windows. Seiz'd with the noble rage of astronomy, he snatches up the earth from the centre of the universe, sends her packing, and places the sun in the centre, to which it did more justly belong. The planets no longer turn round the earth, nor inclose it in the circles they describe; if they give us light it is but by chance, and as they meet us in their way. All now turns towards the sun, even the earth herself; and Copernicus, to punish the earth for her former laziness, makes her contribute all he can to the motion of the planets and heavens; and now, stripped of all the heavenly equipage with which she was so gloriously attended, she has nothing left her but the moon, which still turns about her."

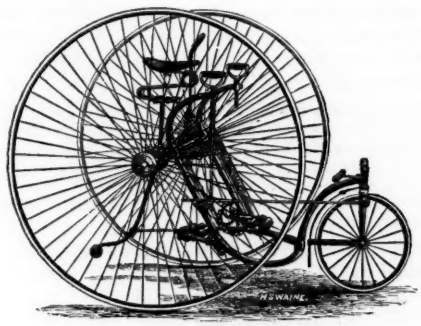
(*To be continued*).

THE TRICYCLES OF TO-DAY.

THE "ROYAL SALVO" No. II.

THE makers of this justly-celebrated, double-driving, front-steering tricycle, the "Salvo,"—Messrs. Starley Bros.—can lay claim to the fact that the machine known as the "Coventry Lever" was the first type of tricycle ever made in this country, it being the invention of the late Mr. James Starley, who is rightly regarded as "the father of the iron steed"; and only quite recently the mechanics of Coventry, in appreciation of the immense service the founder of the present firm rendered to their native town by creating an industry which has amply recompensed them for the loss of their ribbon trade—for which Coventry was once so famous—have recently erected a monument to his memory.

Of course, not a single season has passed by without finding the machine greatly improved, and the "Royal Salvo" of to-day is a very different piece of mechanism from the progenitor of its race, which, by-the-bye, was a rear-steerer, having a large safety-wheel in front, which ran on the ground like the rear-wheel. The original machine bore the lengthy title of the "Salvo-Quadricycle." After a few experiments, however, it was found highly dangerous in descending hills at anything like a high speed, and, in consequence, was quickly altered to a front-steerer, in which form it has ever since been wisely allowed to remain.



The Royal Salvo Tricycle.

About four years ago, one of the firm had the honour of delivering in person two machines to no less a person than her Majesty herself at Osborne, her Isle of Wight residence, and with those machines she has since expressed the greatest satisfaction.

The "Royal Salvo" No. II. differs from the ordinary "Salvo" only as regards workmanship and weight, being a better-finished and considerably lighter machine than the latter, though built exactly on the same lines. The framework of the machine is constructed entirely of weldless steel-tubing. The front-steering wheel is supplied with Bown's ball-bearings, while roller ones are fitted to the two driving-wheels. The latter, I believe, are the oldest bearings which exist, and are unmistakably the best bearings made, being well-nigh indestructible, if only kept well-oiled and free from grit.

The steering-wheel in front renders a spill scarcely possible when ordinary caution is used.

It is well known that if a rider presses too hard on the pedals the front wheel will leave the ground. The back-stay of the "Salvo" prevents it from being lifted so far off the ground as to permit of the machine turning over backwards.

The lever band-brake fitted to the machine is as perfect as a brake can be, being far preferable to a tyre-brake, which is not only liable to pitch an inexperienced rider out if applied too suddenly, but may snap at any time when least expected, and with constant usage cannot fail in time to wear the tyre away or cause it to work loose.

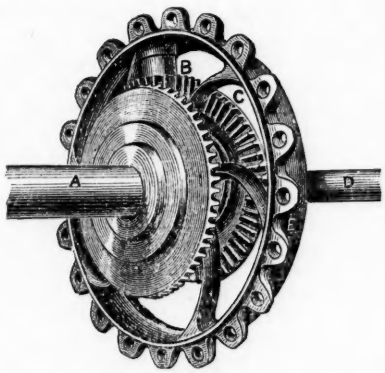
No matter if the hill be as steep as a roof, there need be no fear of descending on the "Salvo," since the brake is sufficiently powerful to check the machine on any incline whatever, and at any speed. Neither need there be any fear of applying the brake promptly and vigorously—as, for instance, one is often compelled to do in the case of unexpectedly coming on children playing in the road, who

invariably run in front of the machine, instead of out of its way.

One of the most pleasurable features of tricycling to my mind is descending hills at considerable speed, and on this machine the rider may do so at all times safely without being robbed of his pleasure by a constant dread of the brake snapping or not acting in some way in case of emergency.

The machine is also supplied with comfortable, rubber-clothed foot-rests, which, besides being a great luxury in riding down-hill, enable the rider on a good level road to take an additional rest by pedalling with alternate feet.

But the best feature of the machine is its patent automatic balance-gearing, an illustration of which is here given (through the kindness of Messrs. Starley Bros., of Coventry).



A.—Bevel tooth-wheel, fixed to the hub of one driving-wheel. B.—Crown-wheel. C.—Bevel-wheel fixed to shaft. D.—Main axle. E.—Chain-wheel.

The axle connecting the two large driving-wheels is telescopic, the central shaft from the right wheel working in a hollow tube from the left.

The chain-wheel works between two bevelled cog-wheels, one of which is attached to the hub of the right-hand driving-wheel, while the other is attached to the end of the hollow shaft that proceeds from the left hand.

Between the two cog-wheels works loosely the collar that forms the centre of the toothed chain-wheel, while on a rod which passes from the centre to the circumference of the chain-wheel works a small, loose cog-wheel, whose teeth are so bevelled as to work against the teeth of the other two cog-wheels.

While the machine is being driven in a straight course, the teeth of the little cog-wheel press evenly against the teeth of the other two cogs, and equal power is by this means imparted to both driving-wheels. But should one wheel be rotated more slowly than the other, as in turning corners or steering the machine completely round, the little cog or pinion-wheel glides freely over the face of the bevelled cogs that move the inner or slowly-rotating wheel, while it presses with more force against the cogs of the outer wheel, thus causing it to rotate with greater speed.

The great advantage of this simple mechanism is at once apparent in the facility it gives of turning sharp curves without the risk of the machine tilting over. It also can be worked backwards or forwards with equal effect. While at all times the machine, by the use of this gearing, is kept thoroughly under control. With reference to its luggage-carrying capability, there are few machines to surpass it, the amount of articles one can fasten to the detachable luggage-carrier behind being something prodigious.

It is in consequence a capital machine for an amateur photographer who wishes to take sufficient paraphernalia to photo any lovely bit of scenery he may meet with on his tour.

I advise those persons, however, who are above the average weight, or who live in a district where roads are bad, to ride an ordinary "Salvo," on account of its greater strength; whereas, on the other hand, for ladies, or those whose weight does not exceed 10 st., and who are fortunate enough to live in a neighbourhood of good level roads, with smooth surface, I strongly recommend their "Special Light Salvo."

With regard to height of wheels, I should recommend a 46-in., geared level, for those whose height does not exceed 5 ft. 9 in., and a 48-in., geared level, for those above this height.

Undoubtedly the "Royal Salvo" No. II. is one of the very best machines made. F.

EMBALMERS.

THOUGH in America embalming be on the increase and even bids fair to be one day popular, there can be no doubt that with us the practice does not gain ground.

We are a sensible rather than a sensitive people, and, unable to grasp any very definite reason for encouraging the art, we scarcely notice it. We have, in fact, no desire to have our dead, like our poor, always with us. But, nevertheless, there are in each year a certain number of cases of tolerably regular occurrence, and, to meet that demand, a small supply of practitioners, authorities on the subject, employed by the undertaker, who, as a rule, is the person first consulted.

Compared with the ancient, the modern method is rapid and simple; with the Egyptians, the process was a question of months, with us it is one almost of minutes.

Here it is, as practised by Dr. B. W. Richardson, the eminent authority on health, who has probably had a wider and longer experience than any other man in the country. "A large artery is exposed and opened, and into the vessel a hollow needle is inserted. The needle is firmly tied in its place. Through the needle a solution of chloride of zinc is injected slowly until it has found its way over every part. The principal art that is required in this process is to be very careful not to use too much force in driving the fluid into the tissues, and in not using too much fluid. The fluid which answers best is made as follows:—To two pints of water, at 50° Fahr., add chloride of zinc slowly, until the water just refuses to take up any more of the salt. Then add one pint of water more, and two pints of methylated spirit. The five pints so produced are a sufficient quantity for embalming an adult body. The solution can be injected quite cold, and it will find its way readily over the vessels. If expense be not considered, pure alcohol may be used instead of the methylated spirit.

The effect of the solution is shown by its making the surface of the skin white, firm, and, for a short time, slightly mottled." We have this eminent authority's permission to add that the latest improvement (a discovery of his own,

and not yet published to the world) is that of injecting through the *optic foramen*, by the introduction of a long subcutaneous needle into the cavity of the cranium from behind the eyeball. This method, which will no doubt supersede all others, was discovered rather by accident than direct experiment, and dates from researches conducted by Dr. Richardson on the best modes of restoring animation after sudden dissolution from chloroform and other lethal substances. Thus, in original work it often happens that, in carrying out a design which has been most carefully projected, the original intention is not consummated, but some other result which was never thought of; and thus Columbus, in search of the golden lands of Marco Polo, accidentally lighted on the continent of America. It will be noted that in the modern system nothing of the ancient survives. There is no exenteration, no steeping in palm-wine, no filling of the cavities with myrrh and cassia, no swathing with bandages a thousand yards long, which, nowadays, the pilfering Bedouin use for clothes and sell for paper. Nor is there any need for the παρασχιστής, that low-caste official, whose hateful duty it was to make the first incision, and who must needs have been as nimble of foot as he was quick of hand, since (all in Egypt being held in abomination who mutilated the dead), on the completion of the operation he had to make the best of his way into the country, pursued with sticks, stones, and curses. There, in a date-grove, he panted till the storm had blown over. He was the original, they say, of the familiar phrase *to cut and run*. Nor in our civilisation is the attendant expense in any degree as great. It ranges from 20 to 50 gs., varying with the circumstances of the survivors. Mr. Whiteley, whom we have consulted, will undertake an adult for £42. 10s., while the best workmanship of the Nile could not be secured for less than a talent, £243. 15s. In a sketch of this rapid character, in which we have striven to avoid as far as possible all unpleasant details and tiresome technicalities, there is necessarily much omitted that is historically interesting, though more perhaps to the student—if any such there be—than to the general reader. There is that Guinea tribe, for instance, who by some mysterious process reduce their relatives to a liquid condition and drink them down; and so, perhaps, have given rise to the saying that the society of certain individuals is refreshing. There is the desiccation practised by the Palmeritans, who put their friends aside in a chamber underground to dry, where they may still be seen in all the dreadful contortions of the process. There is Marshall's system of puncturing the surface of the body and brushing t over with acetic acid of the specific gravity of 1·048—"two days' application in this way will beautify any subject." There is the tadpole arrangement (though we cannot be sure that this has ever been applied to the human frame) by which a subject, suspended in water and left free to be acted upon by the suction-mouths of these little creatures, is in a short time stripped of all those parts which would otherwise decay. There are the natural mummies of the sands and of the bogs of Ireland and Scotland, and the lost travellers of the Alps, in a sense preserved by cold; and, not to be tedious, there is that buried secret of the Florentine physician Segato, by the exercise of which he could reduce the dead, Medusa-like, to stone. By this process of Segato's the head of the patriot Mazzini was, we believe, successfully treated, and still, no doubt, is in existence, the cherished treasure and pride of some Italian municipality; and though, as a means of preserving the dead, the method was never widely known or popular, yet it found its way into England; for we have been told, indeed, by the greatest living authority on mummies, that, many years ago, when present at a conversazione in London where several specimens of the Florentine's art were exhibited, he discovered among them a table inlaid, apparently with strange and curious marbles, but which on closer inspection resolved themselves into the interiors of dead friends.—*Cornhill Magazine.*

ELECTRO-PLATING.

IX.

By W. Slingo.

IT frequently happens that large statues are taken by the electrotyping process. Sometimes the object in view may be simply to copy one sculptured in marble, &c.; at other times a bronze statue may be the thing desired.

To attain such an object, one of two processes is generally adopted.

In the case of a plaster figure, the surface of the statue is saturated with linseed oil, and then allowed to dry. When quite dry, it is thoroughly plumbagoed, the surface presenting a uniform polished appearance. It is then placed in the solution, and a deposit is taken, the thickness varying with the size of the work. It must be sufficiently strong to be used as hereafter described. As intimated in the previous article, care is taken to insure a good deposit in the hollows by inserting small anodes in them, and keeping the main anode either a considerable distance away, or out of the bath altogether. Where this course is rendered impracticable by peculiarities or eccentricities in the shape of the mould, the anode is for a time placed at some distance from the cathode. This plan is in the main objectionable, and it is often found better to employ a current of high electromotive force at the commencement of the action. This, when using batteries, is easily done by introducing one or two extra cells "in series," and withdrawing them as soon as the mould has received a copper deposit all over it. When the coating has attained a sufficient thickness, the mould is withdrawn and the metal cut in halves, or in other convenient sections. The plaster is then sawn through, and afterwards extracted piece by piece until the whole internal copper surface is free. In this process the plaster model is thus sacrificed. When thoroughly cleaned, copper wires are soldered or otherwise attached to the external surfaces of the various copper sections. These surfaces are then "stopped off" with gutta-percha varnish, that is to say, they are coated with the varnish consisting of gutta-percha dissolved in bisulphide of carbon (CS_2) to insulate them, and so prevent deposition upon them when placed subsequently in the electrolytic bath. When thus provided externally, the internal surfaces are treated with turpentine, exposed to sulphuretted hydrogen fumes, or dipped in a weak solution of sulphide of potassium. The object of this treatment is, while it allows deposition to go on, to prevent the adhesion of such deposit to the original copper form. The copper sections having been treated in this manner, are again placed in the bath, and a good, substantial deposit is taken. When these positive sections are sufficiently thick, they are withdrawn from the solution, together with their previously-taken negative films, which are carefully stripped off, exposing clean and clear surfaces bearing an impression of every feature pertaining to the original plaster model. The sections are then trimmed, any superfluous pieces of metal being clipped or filed away. After this they are fitted and soldered together, and the joints bronzed over.

This method is largely employed where the work is

required to be well done; but the extra expense involved in the sacrifice of the model, in taking two electrotyped impressions, &c., forms an important factor in determining upon the course to be adopted and the method to be employed. The method is, however, a safe one, and may be relied upon to give a first-class representation of the original figure. It was the one employed by Messrs. Elkington in producing their colossal statue of the Earl of Eglinton, 13½ ft. high, and weighing two tons. The capacity of the bath employed was 6,680 gallons. Another firm produced a work by this process weighing nearly three and a half tons.

Another process may be employed which does not involve the sacrifice of the model, and that is to take sectional plaster casts, and then, after saturating them with linseed oil and well coating their surfaces with plumbago, to place them in the bath, whence direct positive impressions may be taken, and treated in the ordinary way. The various sections are cleaned, fitted and soldered together, and the joints bronzed over. The casts need not necessarily be taken in plaster, wax or some other available substance answering almost equally well.

Bronzing is a branch of the subject to be dealt with presently; but before leaving the discussion of the typing processes as applied to large work—large, that is to say, in comparison with that with which we have next to deal—it may be as well if a few remarks are made upon the probable causes of failure and the steps that may be taken to avert a failure. It must be distinctly borne in mind that the perfect practice of every art is more or less the outcome of experience and experiment, and that, therefore, one can scarcely hope to turn out excellent work as the result of a first effort.

In the great majority of cases failure may be ascribed to an imperfect mould, or to an imperfect conducting surface. A great deal, of course, depends upon the condition of the bath and of the battery, but even when these are all that could be wished, difficulties and disasters present themselves which are attributable to one or other of the causes referred to. In the first place, every care should be taken to prevent "air-holes" forming between the mould and the original. In using gutta-percha the injunction to work it outwards from the centre and to apply a gradually-increasing pressure must not be lost sight of, and generally it may be said that to work from the centre is one of the readiest means of securing the absence of these holes. There are, however, times when even the greatest care is insufficient to insure immunity from this trouble, and when one can only hope that things have gone well. This is especially applicable when the object is so much under-cut as to involve the production of an elastic mould. The chief safeguard against air-holes in plaster moulds is to use a thin material and to aid its distribution with a hard brush or a small piece of wood. The brush should be transferred to a vessel containing water immediately after it has been used. Gutta-percha has the disadvantage of contracting on solidifying, and hence the necessity for the increasing pressure.

It follows from what has just been said that a careful and thorough scrutiny of the mould, prior to its being blackleaded, is imperative. Electrotyping is a faithful process, and shows up the blemishes of a model quite as prominently as the beauties. Being satisfied that the mould is good—that is, that it reflects perfectly the object we are desiring to copy—the next care is the blackleading. Only the best plumbago should be used, and care is necessary to reject any gritty particles that would be likely to scratch the mould or to impart their impress to the face of the electrotype. The plumbago must be rubbed on thoroughly and carefully, and nought should satisfy the worker short of a bright, polished surface, free from spots or specks. The appearance of holes in the copy is often due to an imperfection in the conducting surface. The plumbago should not be allowed to reach to the back of the mould or to any other undesirable point. Should it do so, the best plan is to cover up the excessive particles with varnish, oil, wax, or some such substance. Plumbago, however, cannot always be used, and then the best course open is to apply the phosphorous and silver process. As we shall see hereafter, this process is not always practicable, as the phosphorous is apt to render the copper surface more or less brittle. Where the mould is in considerable relief, the deeper parts require more careful attention as regards blackleading, &c., than the more prominent portions, because in the first place, the deepest parts of the mould become the highest in the copy, and therefore the most subjected to wear; and, in the second place, because the deeper portions are farthest from the anode, and therefore the path between such part and the anode is one of comparatively greater resistance.

Concerning the manipulation of the cell, there is little to say that has not been already said. The best materials should be used—they are far the cheapest in the end, and save one from interminable disappointment. Where Daniell cells are used, the copper that is deposited upon the negative plate forms the best anode for the bath that can be procured, because of its extreme purity. The bluestone, too, should be as pure as can be obtained. A very frequent impurity is iron, which may be easily detected by placing a small quantity of the solution in a test-glass, and then adding "an excess" of ammonia, that is, adding the solution of ammonia until the copper solution exhibits the alkaline property of rendering a piece of red litmus paper blue. Should there be any iron present, it will be deposited as a dark precipitate at the bottom of the glass. The copper solution becomes of a beautiful blue colour. Pin-holes are sometimes found in the copy, due generally to too strong a current or too feeble a solution, either of these circumstances causing the decomposition of the water, with the result that bubbles of hydrogen gas form on the negative plate (the mould). Sometimes, however, these holes may be due to bubbles of air which have adhered to the mould after its immersion. That bubbles do so adhere may be easily proved by placing a substance under water. Be it never so smooth, the smallest grain of foreign matter is prone to take with it an air-bubble, even if it be only a small one. It is usual, therefore, to wet the surface of the mould thoroughly before placing it in the bath. With small models this is easily done, although with large moulds of printing type it becomes a more difficult task. Then, again, there is the damage that may be effected by removing the mould before the deposition is completed. This, if avoidable, should rarely be done, and under no circumstances should the surface of the copy be touched with the hand, except under water. If the hand or the finger is at all dirty or greasy, there is considerable risk of its leaving a mark upon the mould, over which the copper fails to be deposited.

One of the greatest troubles attending the manipulation of the cell arises from the impurities inherent to all market-obtained copper, and precautions must be taken to prevent them from reaching the mould. Should they succeed in so doing, the probability is that they will seriously affect the deposition, giving it a dirty appearance, and often interfering with the texture. The impurities of commercial copper are very numerous, and equally varied in their proportions. They generally separate from the anode as it dissolves in the solution, and, falling to the bottom of the

bath, accumulate there as dirt. This dirt has been analysed with, as might be expected, very various results. Max Duke, of Leuchtenberg, found a sample to contain tin to the extent of 33·5 per cent., copper 9·4, oxygen 24·82, antimony 9 22, arsenic 7 2, silver 4·45, sulphur 2·46, nickel 2 26, &c. The presence of this dirt forbids the immersion of the mould to the bottom of the bath. It should, in fact, be always well off the bottom. One of the objects in view in making a hole at the bottom of a hollow mould, such as the one referred to in the previous article when speaking of the elastic mould method, is to allow the flow of the liquid to wash out any dirt that may have fallen to the bottom, and which would otherwise injuriously affect the electrotype.

The temperature of the solution is another important, although apparently insignificant, detail. If it is too low the decomposition of the solution and the deposition of the metal are hindered. The temperature should never be allowed to fall below 60° Fahr., but, on the other hand, it should not get much above this point.

In the case of single-faced medallions and such-like objects, when the dimensions are small, the backing of lead may frequently be dispensed with, and a backing of shellac, pitch, or some such material substituted.

With this, I think I may safely leave this branch of the subject. Of course, in describing the process adopted in taking copies of large statues it was not my supposition that the amateur would attempt such work. My purpose was rather to make clear to him the fact that smaller and less ambitious tasks might be attempted with every prospect of success, and that with ordinary care excellent results might be accomplished. My next effort will be to explain the processes to be adopted in plating or typing leaves, flowers, insects, and other more or less delicate objects.

VENUS IN A THREE-INCH TELESCOPE.

By a Fellow of the Royal Astronomical Society.

THE glorious planet we are going to examine to-day surpasses, under certain circumstances, every object in the sky in lustre; and hence the poet in saying that,

> Hesperus that led
> The starry host rode brightest,

simply expressed a bald matter of scientific fact. About a month after she has attained what is called her greatest elongation east, or the same time before she acquires her greatest western elongation, she may be detected with the naked eye in the sunlit sky; and, when in the former phase, casts a very perceptible shadow at night upon any white surface. Her great brilliance under these conditions renders her the most severe test of the achromatism of a telescope that we possess; and an instrument must be perfect indeed that will exhibit an absolutely colourless image of her at this time.

In order that we may have an intelligent idea of what we are going to look at, it will be necessary to recall a few elementary facts in connection with the orbits of the Earth and Venus. Everybody (at least, everybody who will read these lines) knows that Venus goes round the Sun in an orbit inside our own; in other words, her mean distance from our mighty centre of light and heat is 66¾ millions of miles, while ours is 92½ millions. She travels through this orbit in 224·7 days. Now, if we were standing still, she would go through all her phases in this period, and if she were in, say, inferior conjunction (*i.e.*, in a line between the Earth and the Sun) on any given day after 224·7 days, she would return to the same spot. But the Earth itself goes round the Sun in 365·26 days, of course in the same direction as Venus, so that what is called her synodic period (Greek *σύνοδος*, a meeting), or time elapsing between one meeting with the Earth and the next is really 583·92 days. For example, Venus was in inferior conjunction with the Sun at 2 a.m. on the 12th inst. Her next inferior conjunction will not happen until 7 p.m. on February 18th, 1886. Now, if we suppose her to be in inferior conjunction, and also in or near one of the nodes of her orbit, it is pretty evident that she will pass across the face of the Sun as viewed from the Earth, and we shall have a transit of Venus. With this phenomenon, however, we have but small concern here. It last happened on Dec. 6, 1882, and will not recur until June 7th, 2004, when the hand that pens these words and the eyes which rest upon them will alike be dust and ashes. If, though, the planet is far from her node at the time of inferior conjunction, then she passes above or below the Sun as seen by us. On the 12th of July she was nearly 5° south of the Sun's centre. Under these circumstances, as we shall presently see, while nearly the whole of her lighted face must be turned towards the Sun, yet an extremely narrow portion of her illuminated limb is perceptible. As she travels to the westward of the Sun after this as a morning star, more and more of the lighted part of her disc becomes visible; until she assumes the appearance of the Moon when in her first quarter; or, technically speaking, is "dichotomized." As will be seen by any one who will draw a diagram or plan of Venus's orbit, her diameter must appear the largest at the time of her inferior conjunction, and must diminish just as her illuminated surface increases. After attaining her greatest elongation west of the Sun (which can never exceed 47° 15′), the planet appears to begin to move back again, or from west to east, grows smaller and smaller, and when her disc is becoming fully illuminated, disappears behind the Sun in the glare of his light, as merely a rather big star. She is then said to be in superior conjunction. Emerging, after an interval, from his rays to the east of him, she becomes an evening star, and goes through all her phases in the reverse order, increasing in diameter as the area of her illuminated surface diminishes. Attaining her greatest eastern elongation, and then turning back as a rapidly-narrowing crescent, she finally returns to inferior conjunction again. This all being understood, we will, at last, go to the telescope.

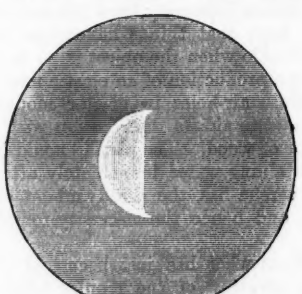


Fig. 1.—Venus, May 10, 1884. Power 160.

At 6 p.m., on May 2, Venus had attained her greatest elongation (45° 27′) east, and eight days later the drawing above was made, with a power of 160, in a 3-in. telescope. Now, two or three things will strike the observer who will carefully scrutinise this sketch. Perhaps the first will be the great brilliance of the illuminated limb of

the planet, and the way in which this contrasts with the inner portion, or "terminator" (KNOWLEDGE, vol. iii., p. 222), shading off into the bright sky. The two little cusps, too, so sharp and bright, will certainly catch the eye, from the want of correspondence of their inner edges with the interior curve of the planet's lighted surface. All this seems indicative of a dense and extensive atmosphere surrounding Venus. One effect of the inner shading is worthy of note, and that is the effect it has in reducing the area of the planet which should be theoretically illuminated. If we draw a plan of the orbit of Venus we shall see that at her greatest elongation she ought geometrically to be dichotomised, *i.e.*, exactly half-full; but it will be seen that in reality she is rather less than this, the degradation of light towards the terminator being pretty rapid. Observers of repute have seen the terminator jagged and uneven, like that of the moon; but it is too much to expect of a 3-inch telescope that it should exhibit such difficult features as this. A blunting of one or both of the horns has also been perceived at times by various astronomers, both in this country and on the Continent. And, what is of considerable interest to the possessors of instruments of the size employed for the purpose of these papers, very faint dusky spots and bright patches have been perceived from time to time in telescopes of the most varying apertures; small ones showing these spots as well as, in fact better than, some of the larger instruments. This may possibly arise from the general glare of light in a large objective or mirror deadening the eye to such delicate details. It is by the aid of these spots, real or imaginary, that the hypothetical period of rotation of Venus has been determined.

But, however beautiful and curious the spectacle may be which is presented by Venus in quadrature, it will scarcely interest the student so much as his first view of her in inferior conjunction. Our succeeding figure exhibits the

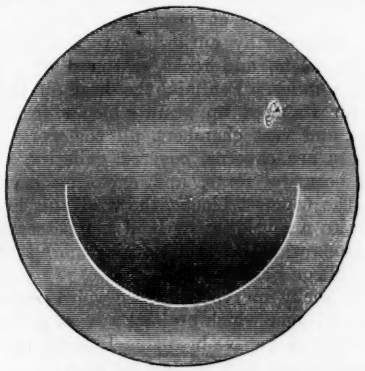


Fig. 2.—Venus in Inferior Conjunction, July 11th, 1884. Power 160.

planet as seen in the same instrument and with the same power as that employed to make our first sketch with. The contrast between these two aspects of Venus will arrest the attention at once. The comparatively small half-moon has become converted into a hair-like glittering semicircle of light, enclosing something which is certainly darker than the surrounding sky. The very abnormally hazy condition of the atmosphere which has now persisted for many months was against the perception of any very delicate gradations of shade, so that the whole of the dark body of Venus was invisible; but the effect, difficult or impossible to reproduce in a wood-cut, was that of a disc dark where embraced by the crescent of light, and fading into the light of the sky outside or beyond the cusps. On the occasion of former inferior conjunctions, the whole of the planet's dark limb has been unmistakably perceived. In order that it may be seen to the greatest advantage, a *very* small diaphragm should take the place of the ordinary one between the two lenses of the Huyghenian eye-piece. A blackened card disc with a fine hole made centrally in it with a red-hot needle, answers capitally. The hot needle burns the fringed edge of the perforation and leaves it clean and sharp. The smaller the hole, consistently with distinct vision, and the more sky light that is cut off, the sharper and better will the body of the planet appear. This little device will always be found useful when any body is to be viewed in bright sunlight.

There is a queer story—or, perhaps, it would be more correct to say a series of queer stories—with reference to various observations of a satellite or companion to Venus, situated always close to the planet, sometimes on one side of her, sometimes on the other, but always exhibiting a phase identical with her's. The most feasible explanation of this is that it has had its origin in each case in what is called, "a ghost" in the eye-piece, *i.e.*, in a reflection of the planet's image from the convex surface of the eye-lens on to the plane surface of the field-lens, and so back to the eye of the observer. An observation made by Short, the famous optician, in 1740, who did use two different telescopes, seems the only one to throw any legitimate doubt upon this explanation. M. Houzeau, the eminent Belgian astronomer, however, is so convinced of the objective reality of the various apparitions of this satellite that in *Ciel et Terre* for May 15th of the present year he gravely propounds the hypothesis that a little planet (which he provisionally names Neith) revolves round the sun in an orbit just exterior to that of Venus herself. Here there is an opportunity for the student to distinguish himself. He has only to watch Venus day and night until he picks up this attendant, to do so. Whether, though, he succeeds, or whether he fails in this attempt, he will find himself amply repaid for any amount of labour by the diversified but always beautiful appearance of the planet as she speeds on her path round the sun, and may find infinitely less profitable ways of spending his time than by the devotion of a daily half-hour to watching Venus in a Three-Inch Telescope.

BRITISH SEASIDE RESORTS,

FROM AN UNCONVENTIONAL POINT OF VIEW.

By PERCY RUSSELL.

II.

TAKING all England, and making proportional allowance for inland as against sea-coast populations, it would probably be found that the line of shore between Cromer on the north-east and the Bill of Portland on the south-west, is the best-known, perhaps, of all the coast of England to the greatest number of people. If, *per contra*, we take the much more sinuous shore-line from Portland Bill by Start Point, Falmouth, the Lizard Head, the Land's End, and then northwards to the splendid estuary of the Severn, and thence to St. David's Head, that western headland of Pembrokeshire, we shall follow a coast-line that, except at a few points, is unknown in detail as it is unvisited by the multitude, but which includes some of the finest scenery of these islands, being in many cases a happy blending of the rugged grandeur of north-west Britain with the softness and almost the climate of Italy itself. The

Devonian heights extend southward to the Cornish highlands, that magnificent series of granite table-lands and hills terminating in the Land's End and in the volcanic rocks of Lizard Point. These highlands average from 800 to 1,300 ft. above the sea level, and from the ridge flow many short rivers through valleys rich with cornfields, orchards, and meadows. The combination of sublime with picturesque scenery is perfect, and on both sides of this peninsula the shore-line is bold, often grand, and constantly indented by beautiful bays guarded by imposing headlands.

Some parts of Cornwall, like Falmouth—the creation, in a shipping sense, of Sir Walter Raleigh—are popularly known to most persons. Here, indeed, may be seen what is in truth a strange sight under English skies—in the form of lemon and orange-trees which yield plenty of fruit growing against garden walls. As a whole, however, this strange peninsula is rather out of the ordinary range of the normal seeker for a seaside resort, and I will, therefore, rapidly and lightly touch on a few of its salient features.

St. Keverne, near the Lizard, with its quaint houses of unhewn stone, the joints being stopped by that remarkable china clay which is in such demand as a principal ingredient in manufacturing Staffordshire potteries, is one of many examples of the extremely picturesque places to be found in this remarkable region. Here grows the graceful white heath (*erica vagans*), marking out with its pure blossoms the conformation of the serpentine which, composed of silica and magnesia, characterises the remarkable metamorphic rocks of the Lizard. In some places the dark-green masses of crystallised serpentine give a strange aspect to the scene. In contrast to these rocky masses are the marl lands, the true gardens of Cornwall, yielding enormous crops of from eighty to ninety bushels of wheat to the acre, if we may credit local agriculturists. Along the shores the successive cliffs are marked by variety and grandeur. At Nare Point is a cavern 100 ft. long, having, by a singular juggle of some natural convulsion, an ancient beach converted into its roof. Here one looks down on a famous flat known as the Chynals Wollows, of some sixty acres, and lying so low that in heavy gales the sea rolls in and deposits a tribute of fine sand, in constant request for brass castings in the great foundries at Hayle.

The tamarisk hedges strike the stranger as something new. The twigs are reported to be possessed of tonic properties, and were once in high repute in the days of domestic herbal medicine. Cliffs, caves, strange fissures, and extraordinary monoliths are among the common things of this romantic shore, and here, in the eighteenth century, there was, for a considerable period, a squadron of six smuggling vessels, manned by 235 first-rate seamen, carrying 56 cannon, and maintaining for some years the command of these wild seas, notwithstanding all the King's cruisers could do.

This is but a patch of local colouring—a stray note in respect to the great and varied interest of these rugged shores. Penzance presents perhaps the most striking sight in the district. A mountain rises with ineffable grandeur from the midst of a lovely bay, beautiful in summer as Baiæ itself, which Horace, by-the-by, preferred, he said, to all other watering-places in the Roman world, and, shooting up with stern abruptness, culminates in one of the most noteworthy pinnacles of the county. The precipitous sides are in strong contrast to the fertile lands around, and from St. Michael's Mount is a magnificent prospect of the Channel. At Penzance you can command both the English and the entrance to the Bristol Channel. Here gigantic rocks are piled about mute witnesses of some tremendous forces at work when, this portion of the British Islands was roughly fashioned into its present form; here are the famous "Logging" or Loganstones—one of over a hundred tons being so delicately poised that it moves at a touch, and afar in the distance appears the Scilly archipelago. The island giving its name to the group is almost inaccessible, and only five or six of the islands are regularly inhabited. These were the Cassiterides, or, perhaps, the Hesperides of the ancients, and they abound in strange monolithic monuments. Tresco, which lies between Bryhher and St. Martin's, was granted by Athelstan to some monks in 936. St. Mary's, the largest member of the group, is quite a little kingdom in miniature. Hugh Town, the capital, is remarkable for the mingling of very old-fashioned with neat modern houses, and has an excellent pier, a post-office, and custom-house. In Tresco may be seen the vestiges of a tenth-century abbey, and of a camp traditionally assigned to Oliver Cromwell. Druidic remains — some real, and many, I suspect, fanciful—abound, and the geologist is certain here of a rich field for operation. On leaving the mainland to visit this singular cluster of rocky uplands—the highest points, no doubt, of an enormous submerged country—a splendid view is to be had of the Cornish coast formation here. In some instances, the promontories have a close resemblance to feudal castles. The thirty miles or so of sea between the Land's End and the Scilly Isles was once the famous Cornish champaign, and known as Lethowson, or Lyonesse, and is said traditionally to have included about a hundred and fifty churches. The landmarks of this submerged region are the Wolf Rock and the Seven Sisters—a cluster of cliffs whence fishermen of yore are said to have hooked up unmistakable evidences of a lost civilisation. Some persons may think this exaggeration, but in 1817, in a January storm, it was for some hours extremely doubtful whether the sea would not break right through the country to St. Ives, and thus reproduce in the Land's End another Scilly group.

As to the Scilly isles, some of the books I have consulted make them to number at most some forty or fifty, but other more trustworthy authorities reckon up full three hundred isles, islets, and rocks, scattered over an area of thirty square miles. Penimis, the head of the isles, is noticeable for its piled up granite blocks, forming walls, rude arches, and vast chambers, all the work of natural forces. There are caverns, covered galleries, and vaults hung with beautiful ferns, and enclosing crystal pools, while from the topmost blocks, the wild and lovely scene would be quite a revelation of land and seascape to thousands of persons who have seen nothing more striking than the Dover cliffs or Beachy Head.

One of the rocky marvels of these weird regions is the "Pulpit" rock, over which projects a vast granite coping, fifty feet long, and twelve broad. It looks unstable, but is secure enough, and may yet last for ages.

In these southern regions of England we have the wildness and much of the sublimity of the Scottish Highlands, mingled with and softened by a vegetation unknown in other zones of the island. At Penzance, the decomposed greenstone is marvellously fertile, and plants from Australia that will grow at Kew only under glass, here thrive out of doors. A perpetual southern spring reigns, but the nearness of the sea to all points of the land tempers what would be an oppressive heat at seasons; and even in "winter" the days are comparatively warm, and the sun is nearly always shining. The mines are, of course, a source of interest, but these hardly come within my present scope. Few, if any, counties of England present such examples of longevity among the inhabitants, and undoubtedly the purity of the atmosphere and the proximity of the sea to all points of the peninsula are in themselves highly hygienic

XUM

conditions. The granite spine or ridge that divides the peninsula with its successive peaks—Brown Willy, 1,368 feet; Caradon Hill, 1,208 feet; Kit Hill, 1,067 feet; and Hensbarrow Beacon, 1,034 feet—help to complete the resemblance of Cornwall to a miniature Italy; and the fact that the Balm of Gilead—a species of tree flourishing in Arabia and Abyssinia—grows out of doors sufficiently establishes the softness of the climate. Marazion in particular, known as Market Jew, has special salubrity, being at the foot of a hill on St. Michael's Bay, and entirely sheltered from every cold wind. Marazion, by the way, is supposed to be the most ancient town in Cornwall, and is very near the famous Ictis, the great Tin Mart of ancient story.

Sweeping round northwards, and facing the Irish Sea, we find the Devonian heights on the one hand and the seaward ending of the Welsh mountains have, between them, formed a coast abounding in picturesque features and in noble scenery. Proceeding northwards along the Cornish coast, under the shelter of the high lands, we pass numerous points of interest like Padstow, Tintagell, and, reaching the Devonian shores, pass Bideford, on the banks of the Torridge, Barnstaple, and reach Ilfracombe, standing among picturesque and irregular hills, and having a harbour formed by veritable ramparts of rock. Here begin the special beauties of the Bristol Channel, the extension, in fact, of the magnificent estuary of the Severn. This is the grandest estuary of all Great Britain, and has a most irregular coast-line of 220 miles; and here may be seen tides that rise to heights ranging at Bristol from 35 ft. to 70 ft. at Chepstow. The phenomenon of the *bore* is also a special marine feature, and shows the ocean advancing like a wall of water, as much as nine feet above the normal level. It is this bore or tidal wave that rushes up the broad mouth of the Severn, which, by the way, at its junction with the Wye, presents one of the most famous water views of the kind in all England. On the north of the Bristol Channel, Glamorganshire (in Welsh, Gwlad Morgan) has a coast-line of full ninety miles, and includes the land of Gower, that remarkable peninsula projecting into the Bristol Channel with deeply indented and highly precipitous coast. Then comes the wild Caermarthen coast, the birthplace of Merlin and having in Tenby what has been generally allowed to be one of the most beautiful and romantic places in these islands. It stands on a kind of promontory, and three miles away is Caldy Island, with many interesting archæological associations. The lodging-houses here are mostly on a high cliff, and the view across to Pembroke, on the shores of Milford Haven, is certainly unsurpassed for beauty. The grand approach to Pembroke is by water, and this enables its castle, which is justly ranked among the most splendid monuments of antiquity in South Wales, to be seen to advantage. The town principally stands on the ridge of a long rock. Under the chapel of the castle is the famous natural cavern known as the Wogan, which commu nicates with the harbour. One matter worthy of special note for the tourist is that in Pembrokeshire, originally settled by Flemish emigrants, English is generally spoken, and, indeed, this county has sometimes been called the Little England beyond Wales. Milford Haven is a truly wonderful expanse of sea, landlocked by steep hills, rich with vegetation and abounding in splendid views from all points of the compass. As a harbour, the Haven is hardly equalled in the world, and it is entirely protected from winds by its green girdle of hills. It is full seventeen miles by two or three. Proceeding onward by the coasts we reach St. David's, once a splendid, and still an interesting place. Off Whitsand Bay there are six singular islets, quaintly known as the Bishop and his Clerks. Next we reach Fishguard, and thence to Cardigan on the mouth of the Tyvi. This was anciently *Aberteif—i.e.*, the mouth of the Teif or Tiyvi. The scenery here is highly romantic, and the coast-line is marked by rocks of great grandeur. It is worthy of note that this Welsh river is believed to have been the very last retreat of the British beaver. Cardigan Bay is a fine semi-circular bend, having a coast of nearly 111 miles, and being swept by a strong current from south to north, and obstructed by bars, it is rather dangerous for navigation. A great part of this grand bay is believed to have been formerly dry land, and had at least sixteen towns, and, tradition says, was entirely submerged during fearful storms in or about the year 520 A.D. This is decidedly a striking parallel to the submerged Lyonesse off the Land's End, of which I have spoken above. Cardiganshire, the great maritime county of West Wales, rests on the lower Silurian slates, and sends down from its rugged hills abrupt slopes to a steep beach. This county is remarkable for containing full twenty lakes or *llyns*, justly celebrated for their beauty, which is of the wild and even terrible order, and for its romantic waterfalls, particularly that known as the Rheidol Falls, and the Devil's Bridge. This is a single arch, crossing a chasm, and was diagonally erected by the monks of Ystrad Fflur Abbey, near the source of the Tyvi, in the thirteenth century. The stream of the Mynach descends impetuously from mountains about five miles, and roars beneath the bridge at a depth of 114 feet. The total fall of the Mynach is no less than 322 feet. It was this county that gave, in 834, a king to all Wales; and throughout are many interesting remains of British and Roman camps, cairns, castles, and Druidical circles. Carnarvon is another of the romantic counties of Wales, and is traversed by the grandest mountains of South Britain. Here is the great Snowdonian range, culminating in Snowdon, 3,571 feet above the sea-level. The Menai Straits are well known for such features, of course, as appear in guide-books, and such glimpses of the special features as travellers to and from Ireland may obtain *in transitu*. Ample British and Celtic remains abound here to occupy the antiquary, but it is in Anglesea—which means, by the way, the Englishman's island, that the richest store of archæological and very ancient historic remains are to be found. This was the Mona of the Romans, and was the great stronghold of Druidical power. It has a coast-line of eighty miles, and possesses a milder climate than does the Welsh mainland, only it must be avoided in autumn, when the air is charged with very disagreeable mists. Beaumaris, with its ivy-clad castle, dating from Edward I., stands on a picturesque bay, and is a pleasant seaside resort in summer. From the Anglesea coast near the Tal y Moel ferry house, the town of Carnarvon, with the Menai Straits in the foreground and the lofty mountains of the Snowdonian range in the background, forms a picture of striking beauty. The Bay of Beaumaris is very sheltered and shallow, and at low water the Laven sands extend for miles. These, again, in parallelism to Cardigan Bay, once formed dry and inhabited land, and were inundated in the sixth century. In the churchyard of Abergele, a Caernarvonshire village, is a Welsh inscription, saying that there lies a man whose dwelling was three miles north, *i.e.*, where now roll the breakers of the Irish Sea. Another pretty conclusive evidence of the fact that a great strip of land was here entirely submerged arises from the fact that the boles of some vast oaks have been discovered during extraordinary low tides. The lofty mountains of Wales, broken by the Bristol Channel to reappear as the Devonian, and then the Cornish highlands gave in their hard declivities on the west a new coast-

line, probably at some very remote period to this island; and but for the Cornish islands there can be little doubt but that the land's end south would have been furnished by Devonshire. A remarkable feature of Carnarvonshire is the promontory of Llyn, which juts out to sea, and includes many highly picturesque places, like Clynog, which, backed up by mountains, and with its houses half-hidden in refreshing foliage, presents the very perfection of a seaside resort where repose and natural beauties are the main desiderata. The principal town, however, on this remarkable promintory is Pwllheli. Some twenty-four miles away lies the Isle of Bardsey. Some portions of the coast are perpendicular, and others actually overhanging, producing a remarkable effect. Immense multitudes of birds build in the crevices of this cliff, and the collection of their eggs is quite a staple occupation. On the south-east Bardsey is accessible. In 1840 the population numbered just 84. It is remarkable that no kind of reptile has ever been seen in Bardsey, which is in Welsh known as the Refuge of the Saints. At the end of the promontory is a bay in which every ship once entering must be inevitably stranded, as, from whatever quarter blows the wind, the current always sets powerfully inwards, and among seamen on the coast this inhospitable and fatal bay is known vulgarly as Hell's Mouth.

(*To be continued*).

A CATASTROPHE AVERTED BY ELECTRIC WIRES.

THE *Scientific American* learns by a letter from Rev. H. C. Hovey, that the new drill hall of the State University, at Minneapolis, was struck by lightning on June 12, with attendant phenomena of interest. This building, locally known as the University Colosseum, stands on a bluff overlooking the Falls of St. Anthony, occupying the highest ground in the city. At 2 p.m. there were 1,000 children assembled on the stage, and about 3,000 persons in the audience. A thunder-storm arose, and while the children's choruses were going on, it was noticed that the series of electric lamps, fifteen in number, hanging from the dome, were lighted at each flash of lightning, going out again at once, and there was a sense of uneasiness pervading the people.

Suddenly there was a loud report, as if of heavy ordnance, balls of fire were distinctly seen through the large skylight, and following the electric wires away from the building. Subsequent examination showed that the lightning first struck the flag-staff surmounting the door, thence pierced an oaken beam to which the staff was fastened, the splinters, or the concussion, breaking the glass in the skylight. An iron rod conducted the fluid to the network of electric wires below, where the charge was divided, a portion being harmlessly distributed over the general circuit, and the remainder shattering several electric masts near the building.

A workman on the roof had his shoe torn off and his leg badly burned; and another person in proximity to one of the masts was temporarily paralysed. There was a panic imminent at first, as every one instinctively sprang to his feet and confused cries and shouts were uttered. Dr. Thomas, with great presence of mind, had his orchestra play, and Herr Scaria came forward and sang. Thus reassured, people either remained to hear the music, or quietly left the hall.

At night, an immense audience was present at the Colosseum to hear "The Creation," and quietly sat through another thunder-storm, seemingly satisfied that the electric wires were good lightning-rods. The lamps, however, worked fitfully, now blazing with startling brilliancy, and then going completely out, leaving the audience in total darkness, and then flashing up again. Meanwhile the music went on as if nothing unusual had occurred, both soloists and chorus being perfectly familiar with the score!

What drew the lightning was the metallic ball surmounting the tall flagstaff fifty feet from the wires. The staff and girder to which it was attached were wet, hence became conductors, carrying the fluid along to an iron bolt, beside which it passed through a heavy piece of timber, whence it leaped upon the electric wires, by means of which it escaped from the building. There is not the slightest doubt that the wires performed the duty of lightning-rods in this instance. Nor is there any doubt of the grave error of permitting a vast assembly to be gathered into a lofty, unprotected building on an eminence. The intensity of the current fused the fine wire circuit feeding the lamps, which accounted for the spasmodic working of the lamps, the wonder being that they should have worked at all after being subjected to such a strain.

Mr. Noyes, foreman of the Brush Company, tells an interesting experience. He was at work on the wires previous to the storm, and kept on after it burst, although aware of his danger. At the moment the building was struck he was splicing the wires directly above the central lamp, meanwhile taking every precaution possible under the circumstances. For a few minutes he lay unconscious, and then, regaining his senses, descended to the ground. He says that he did not feel any pain until he reached *terra firma*, when he suffered intensely in his right foot. On examination he found that the bolt had struck his leg below the knee, tearing the clothing to shreds, bursting open his stout boot from heel to toe, and blistering the flesh as if with a hot iron.

TRICYCLES IN VICTORIA.—The Postmaster-General of Victoria has it is said, decided to make a trial of the tricycle postal delivery system at Portland, Sale, and Ararat. If the plan should be successful, he will have it extended to other districts at an early date.

ELECTRIC LIGHTING IN LONDON.—The Board of Trade have decided to proceed at once to revoke no fewer than twenty-five of the provisional orders which were granted by them last year, and subsequently confirmed by Parliament, for the electric lighting of London and its suburbs. Of this number twenty-three are orders which were obtained by the Metropolitan Brush Electric Light and Power Company, which has since gone into liquidation. These orders relate to the electric lighting of Barnes, Mortlake, Bermondsey, Chelsea, Chiswick, Clerkenwell, Finchley, Greenwich, Hackney, Holborn, Hornsey, Islington, Limehouse, Poplar, Rotherhithe, St. George's-in-the-East, St. George the Martyr, portions of the parish of St. Giles, the parishes of St. Luke's, St. Olave, St. Saviour's, Southwark, Shoreditch, Whitechapel, and an order known as the Wandsworth order, which, however, relates to portions only of the parish of Clapham. Of the other two orders which will be revoked, one relates to the lighting of Kensington, and the other is an order granted to the Pilsen Joel Electric Lighting Company, with powers to light those portions of the parish of St. Giles not granted to the Metropolitan Brush Company. So far as London is concerned, the result, therefore, of the numerous electric-lighting orders which have been granted during the past two years, is that only eight now remain in force—namely, the St. James's and St. Martin's order, which, with the Hanover-square, Strand, and Victoria district orders, are now held by the Edison and Swan United Electric Lighting Company, the Hampstead order, granted to the Hampstead Electric Lighting Company, the St. Pancras order, granted to the Vestry, the order for the lighting of Fulham, which was granted only last May to the West Middlesex Electric Lighting Company, and the order, also granted in May last, to the West London Electric Lighting Company, for lighting portions of the parishes of St. George's, Hanover-square, St. James's, Westminster, and St. Martin-in-the-Fields. Of these eight orders, the first five have already had their time extended within which to comply with the provisions of the orders, and unless these provisions are complied with before October 15 next, the powers will be lost, unless a further extension of time is granted.

Reviews.

SOME BOOKS ON OUR TABLE.

Force and Matter. By Professor Ludwig Büchner, M.D. (London: Asher & Co. 1884.)—"Every scientific truth," said our great departed geologist, Sir Charles Lyell, "passes through three stages. In the first it is decried as absurd. Then it is said to be opposed to revealed religion. Finally, everybody knew it before." We are forcibly reminded of the verity and applicability of these words on opening the fourth English (translated from the fifteenth German) edition of the now famous "Kraft und Stoff," which, at its first appearance, twenty-nine years ago, met with such a chorus of virulent abuse from orthodox journals of every shade of thought; but which now would merely be held to push, perhaps rather to an extreme, views held by a large proportion of men of science in all civilised nations. The doctrine of the Conservation of Energy is now so firmly established that no one would seriously take the pains to attempt to controvert or deny it; and, starting from the premises of the immortality of matter and the equal immortality of force, Dr. Büchner essays to explain the entire phenomena of the visible universe upon strictly material principles, to the exclusion of any extra or supernatural agency whatever. In much that he says he would seem merely to have anticipated the irrefragably established facts of modern scientific research; while in other parts of his work it may, we think, be fairly said that his argument rests on assumptions for which adequate proof (in the existing state of our knowledge) is not offered. That every single thought, for example, is accompanied by an actual molecular change—or rearrangement—in the brain is as certain as any fact in physiology. It is, however, taking a very considerable stride to assert with our author that such molecular change or vibration *is* thought. It may not be unbelievable, but it is certainly inconceivable, that consciousness, reflection, and desire can be expressed in terms of motion; and without actual proof of the possibility of such expression, Dr. Büchner's final conclusions must drop to the ground. It is, of course, open to him or to his disciples to retort that where so much that he originally advanced has been shown to be absolutely true, every accession to human knowledge must tend to include a larger and larger proportion of what remains in the same category. This, however, is an argument whose fallacy may be shown by applying it to the contentions of certain people in connection with astrology, spiritualism, &c., and which need not detain us here. On one point there can be but little doubt or dispute—that a work which has passed through sixteen German, six French, four English, three Italian, and two Hungarian editions, and has been translated into thirteen living languages, must be eminently well worth reading, whether we agree with or dissent from its author's conclusions.

The Food Reform Magazine (London: National Food Reform Society.)—This is a vegetarian organ, seemingly devoted to the attempted conviction of mankind that their temporal salvation depends wholly upon their never touching a bit of meat. The whole thing is overdone to an extent which must repel every unprejudiced and impartial inquirer. We note, by the way, on the cover of this magazine an announcement that letters on "Vegetarianism" have been inserted in (*int. al.*) Knowledge; but we do *not* find any mention of the fact that Sir Henry Thompson, who had been publicly quoted by members of their society as an advocate of vegetarianism, publicly contradicted this false and dishonest impeachment on page 407 of our 1st Volume.

Lessons in Social Economy. By James Runtz. (London: Educational Supply Association).—Why Mr. Runtz has considered it necessary to dub his work "Social" Economy is by no means apparent. It is a treatise in a simple and apprehensible form on what every other writer on the subject, so far, has called political economy; and, as an introduction to that science (if it be a science) for the use of teachers in elementary schools, it leaves little to be desired. The tendency of modern elementary education would seem to be towards the loading of the wretched children's minds with a mass of heterogeneous subjects without the smallest thought or care whether they can be understood or assimilated. For earning the "grant," probably political economy is as useful—or useless—as many other things taught; and, admitting this, Mr. Runtz's book is a good and trustworthy one for the teacher's use.

An Epitome of History: Ancient, Mediæval, and Modern. By Carl Ploetz. Translated by Wm. H. Tillinghast. (London: Blackie & Son.)—Herr Ploetz has by no means mis-named his book in calling it an epitome, for he has packed what is practically a history of every nation in the civilised world within the limits of 564 pages. And yet, like all German work, his is done well and thoroughly, and the student who requires a conspectus of the life of any civilised nation at a given epoch will find it in these pages in a simple and convenient shape. While myth has not been excluded, the chronology is of the most orthodox description. The claims of the Chinese, the Ancient Egyptians, &c., to great antiquity are entirely pooh-pooh'd, and everything is smoothed down and squared off to fit in with the hypothesis of the supposed origin of mankind on the earth some 6,000 years ago. For the purpose, however, of such a work as that before us this is scarcely material, as it is only when we emerge from the region of legend into that of the contemporary chronicler that history—as such—possesses the slightest value to the student. The translator has not only done his immediate work well too, but has made considerable additions to the text; in fact the book, taking it altogether, is one of unquestionable value. It is supplied with a first-rate index, which will be appreciated by all who have occasion to consult it.

A Digest of English History, 1689—1760. By M. Gutteridge, B.A. (London: Relfe Brothers. 1884.) This little volume is really what it professes to be, and is something more than the mere cram-book into which so many recent epitomes of history have degenerated. This is doubtless due to the fact that Mr. Gutteridge deals only with a limited period in our national annals, and hence he is enabled to expand his narrative to an extent which renders it intelligible. He gives the leading characteristics of each of the great battles fought during the seventy-one years covered by his digest, and deals with other historical details in a way similarly adapted to impress them on the student's mind. He has produced a useful little book.

Text-book of Practical Solid or Descriptive Geometry. By David Allan Low. Part I. (London: Longmans, Green, & Co. 1884.)—Mr. Low has produced a little book of real value to the student of Architectural or Engineering drawing, containing a large number of problems and a corresponding number of illustrations. After stating each problem, he gives a general solution of it, and this is followed by its application to one or more examples, as the case may be, whose working is, as we have just hinted, always thoroughly elucidated by a diagram or diagrams. He

claims no more than is due to him when he expresses the hope that his endeavour to meet the wants of both elementary and advanced students has been successful.

Half-hours at the Sea-side. By J. E. Taylor, Ph.D., F.L.S., F.G.S., &c. (London: W. H. Allen & Co. 1884.)—The holiday-maker, whose idea of a sea-side trip is comprised in the daily succession of the bath, the novel, and the promenade, need only open Dr. Taylor's work to see what a wealth of intellectual pleasure and recreation lies altogether outside of such stock devices for "killing time." There is no such rest, either for mind or body, as a total change of occupation; and more delightful occupation than the study of the myriad forms of life that people our shores it would be difficult or impossible to find. Beginning with a half-hour with the waves themselves, our author goes on to instruct us in the employment of the microscope, the construction and stocking of temporary aquaria, the use of the tow-net and dredge, the anatomy and physiology, manners and customs, of sea-weeds, sponges, sea-worms, corallines, jelly-fish, sea-anemones, sea mats and squirts, sea-urchins and star-fish, shell-fish, and crustacea. The reader who takes this book with him in his summer or autumn jaunt to the coast, will find that it will supply him with a perennial source of amusement. He who weak-mindedly omits to do so, will cut himself off from an incalculable amount of pleasure of the most novel and exciting kind.

Bringing it to Book is an advertisement of a Mr. Eglinton a (so-called) "Medium," which we decline to forward or further by taking any more notice of it. Professor Ray Lankester and Dr. Carpenter would be the fittest people to deal with this person in the outset, as Mr. Flowers, at Bow-street, would be at a subsequent stage of the proceedings.

THE FACE OF THE SKY.

From August 1 to August 15.

By F.R.A.S.

THE usual daily watch for spots and faculæ will be kept upon the Sun. A picture of the Night Sky will be found in Map VIII. of "The Stars in their Seasons." Minima of the variable star Algol (Map I. of "The Stars in their Seasons") will occur at 2h. 35m. a.m. on Aug. 13, and at the more convenient hour of 11h. 23m. p.m. on Aug. 15. The reader should keep a careful watch on the sky during the nights of the 9th, 10th, and 11th (notably on that of the 10th) for that marvellous shower of shooting stars which has been familiar from classical antiquity; and mediævally designated "St. Lawrence's Tears," is now known more philosophically as the "Perseids," from the fact of all their paths appearing to radiate from a point in the Constellation Perseus ("The Stars in their Seasons," Map I.). These bodies were shown conclusively by Schiaparelli to be travelling in the orbit of a comet (2) which appeared in 1862. Moonlight will interfere to some extent, though not to a great one, with their observation this year. Mercury is an evening star, and may just possibly be picked up close to the horizon after sunset during the fortnight over which our notes extend. Venus is a morning star, and a most brilliant object she is in the eastern sky before sunrise; in fact, by a device akin to that explained on p. 421 of Vol. V., she may be found, and easily seen with the naked eye in bright sunshine, about the time when these notes terminate. No other planets are at present visible. The Moon enters her last quarter at eight minutes past three in the early morning of the 14th, so that the first two or three days of August will probably suit the ordinary observer best for examining her in the telescope. She will occult three stars at convenient hours during the next fourteen days. The first is BAC. 6292, a sixth magnitude one, which on the 3rd will disappear at the Moon's dark limb at 7h. 32m. p.m., at an angle of 139° from her vertex; reappearing at her bright limb at a vertical angle of 190° at 8h. 4m. Then, on the 14th, another sixth magnitude star, 63 Tauri, will disappear at the bright limb of the Moon fifty minutes after midnight, at a vertical angle of 49°. It will reappear at the dark limb at 1h. 45m. the next morning, at an angle from the vertex of the Moon of 253°. On the same night (the 14th) BAC. 1351, a star of the sixth and a-half magnitude, will disappear at the bright limb eight minutes later than 63 Tauri at an angle of 12° from the vertex; but it will reappear sooner, *i.e.*, at 1h. 34m. a.m. on the 15th, at the dark limb, at a vertical angle of 290°. The moon is in Ophiuchus when these notes begin, but at 6 a.m. on the 3rd enter Sagittarius. Hence at 6 p.m. on the 5th she passes into the N.W. portion of Capricornus; there she remains until 10 a.m. on the 6th, when she crosses into Aquarius; traversing Aquarius it is the same hour on the 9th ere she enters Pisces. Her passage across this great constellation occupies her until 10 a.m. on the 12th, at which time she crosses into Aries. She leaves Aries at 2h. 30m. a.m. on the 14th for Taurus; she is still in Taurus when our notes terminate.

Miscellanea.

There is an article on "Scintillation," by M. Ch. Montigny in the number of *Ciel et Terre*, for July 15, containing an account of the naked-eye observations of that phenomenon by M. Ch. Dufour. It should be read by all interested in the curious subject to which it refers.

Accident from Lightning.—It is stated that on Wednesday, the 16th inst., during a storm, a house in the village of Chantemerle, Geneva, was struck by lightning and set on fire. There being no water available to extinguish the flames the fire spread, and the whole village was reduced to ashes.

Steam Ploughing in the West.—Recently, at Fargo, Dakota, a traction engine drew eight ploughs, turning a sod 4 in. thick as even and well as could be done by horse-power, and at a rate of over twenty-five acres per day. The cost of steam-ploughing is rated at about 1 dol. per acre as against 3 dols. per acre by horse-power.—*Engineering.*

Bessemer Steel.—The production of Bessemer steel in the principal countries of the world last year is estimated at 4,852,956 tons. This total was made up as follows: Great Britain, 1,553,380 tons; United States of America, 1,119,576 tons; Germany, 955,000 tons; France, 440,000 tons; Belgium, 220,000 tons; Sweden, 50,000 tons; Russia, 340,000 tons; and Austria, 175,000 tons.

Wednesday's *Standard* says:—"Litigation in respect to patent rights has hitherto impeded the development of electric railways. The Patent Office has now decided in favour of S. D. Field against Edison and Siemens. The first railway was opened at Cleveland, Ohio, on Saturday, and others are expected to be constructed now in quick succession."

The *Railway Review* says:—Buffalo claims to have the tallest telegraph-pole in the world. The Western Union put up one measuring 70 feet, and thought thereby to cut the Baltimore and Ohio off from getting its wire to its office, but the Baltimore and Ohio got a pole 90 feet high, 8 inches at the tip, and set it up within 5 feet of the Western Union pole, so that the two now point to heaven in parallel lines, with the Baltimore and Ohio a trifle ahead.

A sulphur deposit exists at Djemsa, Suez, in a perfectly rainless desert on the African coast, very near the sea, and constituting a hill 600 ft. high, whose sides are blasted down as in quarrying stone. Some 200 Arabs, employed under French engineers, succeed in mining ten tons a day. A similar deposit occurs at Ronga, 500 miles from Suez, also near the coast of the African continent, which differs only in being buried under other strata, so that mining is necessary.

During a slight thunderstorm which passed over the Lake district on Saturday morning last, the corning house at the Black Beck Powder Mills, near Ulverston, was struck by lightning. A terrible explosion ensued, completely wrecking the building, and instantaneously killing three men who were inside. Another man was standing outside the corning house, and the flames from the explosion set fire to his clothing, but by throwing himself into an adjoining brook he escaped with a severe scorching.

Facts concerning Vaccination.—At a meeting of the Vaccination Officers' Association, held on Saturday last, a cordial vote of thanks was given to the National Health Society for issuing their pamphlet entitled "Facts concerning Vaccination." The Association expressed their appreciation of the "thoughtful kindness which prompted the society to assist the vaccination officers of the Metropolis in the discharge of their often difficult duties." We

are informed that the pamphlet in question has now been distributed from house to house in most of the districts in the Metropolis where small-pox is epidemic, and that the demand for it still continues. Something like 150,000 copies have already been issued since the present epidemic began.

The *Standard* says:—"The Midland Railway Company having decided to offer premiums for the best-kept station gardens throughout their system, a kind of Renaissance may be looked for in this branch of horticulture. Other companies are not unlikely to follow suit, and if flowers and fruit are to be objects of competition among station-masters and porters, paint and paper, draughtless waiting-rooms, and a constant regard for the comfort of their passengers may, ere long, be among the objects in which chairmen and directors will struggle to excel. In encouraging their servants to beautify their wayside premises, the Midland authorities are taking an excellent means to increase their business, by encouraging passengers to travel by a line where the carriages are good, the stations pretty, and everybody ready to oblige."

Six Months' Failures (in the States).—The failures for the six months ending July 1 are reported by R. G. Dun & Co. to number 5,510, as compared with 4,637 in the first six months of 1883. The liabilities amount to $124,000,000, as compared with $66,000,000 in 1883. That the failures which have occurred are largely confined to speculative quarters is shown by the fact that the average indebtedness of the parties failing in the last six months is $38,000 for each failure, as compared with $18,000 in the similar period of 1883. A higher average amount of liabilities has been reached in the last six months than ever before. The agency claims that the legitimate business of the country suffered no serious result from these failures; that a condition of preparation for the panic had been reached, and that the balance of the year may witness a fairly profitable demand for merchandise, with results more satisfactory than the first six months have shown.—*Railway Review* (Chicago).

To those persons who are continually stating that there is no speed to be obtained—by *ordinary* riders—on the tricycle, we commend the following facts. A N.L.T.C. rider—who does not claim to be a "scorcher" (in any sense of the word), but merely a *bonâ-fide* ordinary rider, who has a vocation to follow—and who follows it—but yet has the enthusiasm and good sense (like thousands of others) to devote what spare time he has to the wheel—rode, this week, from Theydon Bois to the East of London in 1 hour 30 min., *including* 10 min. stoppage at the Wilfrid Lawson Coffee Tavern. Distance, 15 miles by Thompson's cyclometer, clocked by one of Bennett's chronometers. All hills *en route*—including Buckhurst Hill, which is very loose and rough—were ridden both up and down, and the brake not once used. Machine used was a *bonâ-fide* level-geared 48 in. "Coventry Rotary" roadster. The journey down, in the heat of the day, occupied 1 h. 50 m., including stoppages. He had been suffering two days previously, and his M.D. ordered him to take out-door exercise, and this was how he took it; it is needless to say he is now quite well.—*The Tricyclist.*

The Hudson's Bay Route.—A report on the opening and closing of navigation at York Factory on the west coast of Hudson's Bay, with observations extending from 1828 to 1880, has been communicated by Mr. W. Woods to the Hudson's Bay Company. The latest recorded date of open water in spring is June 1, the earliest closing of navigation November 3. The earliest recorded date of opening was May 4, the latest day of closing, December 9. There is, therefore, some six months of open water on the average in the bay itself, but the communication with the bay and the Atlantic can only take place through Hudson's Straits, and this passage is only clear in July, August, and September, with probably a part of October. Further information on this head is much needed, and it is satisfactory to learn that Hudson's Bay is shortly to be properly surveyed, for the question of its navigability is a most important one to the settlers of Manitoba and the Saskatchewan, since they can ship their exports for Europe by this shorter route, instead of by the Red River and the St. Lawrence.—*Engineering.*

M. Pasteur's Experiments on Dogs.—The series of tests which, at M. Pasteur's own suggestion, were to be made with a view to confirming his theory of protective vaccination by attenuated hydrophobic virus, have now been partially completed; and the result is a complete justification of the faith of those who had confidence in M. Pasteur's statements. So far, fifty-seven dogs have been made subjects of experiment under the supervision of a commission appointed by the French Government, and under conditions arranged between the latter and the illustrious discoverer himself. Of these fifty-seven dogs, nineteen were already afflicted with hydrophobia; and of the remaining thirty-eight, one-half had been previously vaccinated with the attenuated virus. All the thirty-eight were then bitten by the nineteen rabid animals, and the result watched. This completely confirmed the truth of M. Pasteur's assumption of protective power on behalf of the cultivated vaccine matter, for every unvaccinated dog was speedily attacked with unmistakable symptoms of rabies, ending in death; whereas the protected dogs were unaffected by the injuries they had received, and are still in perfect health. In order, however, to make certainty positive, these nineteen dogs will be kept under observation for a full year, when, if they still remain healthy, it is assumed that sufficient proof of their being protected will be given.—*The Medical Press and Circular.*

The Utilisation of the Niagara Falls.—At a recent meeting of the American Association of Civil Engineers, Mr. Benjamin Rhodes described what had been done, and what might be done, towards the utilisation of Niagara for electrical purposes. He said:—"The power of Niagara can be estimated very approximately. The average flow of the river according to many careful measurements is 275,000 cubic feet per second. The fall in the river through the rapids immediately above the fall is 65 feet. The height of the falls is 165 feet, making a total of 230 feet; thus we have for the whole power 7,000,000 horse-power. To utilise this amount of power by water-wheels, generate electrical currents, and transmit to various cities within 500 miles, would necessitate a plant representing at least 5,000,000,000 dols. Such figures as these give some idea of the enormous amount of power here in reserve." He states that on the Canadian side the entire use of the falls is represented by a small over-shot wheel, which propels a pump furnishing a meagre supply of water to the adjoining village. On the American side there are five separate raceways, developing in all 800 to 1,000 horse-power. After describing the hydraulic canal, the greatest power now in use at Niagara, he says:—"Further developments of power at Niagara may be made at little expense. The hydraulic canal can be deepened and widened, and wheels may be set under greater heads, the total amount thus made available here being equal to the necessities of many years. It may safely be said that the use of Niagara has just begun. Low water is unknown; troubles from ice are slight; hours of use are not limited to eight or ten, but 24 hours in the day, and 365 days in the year, and unlimited power is ready, making this the most reliable, as it is the grandest, water-power in the world."

At a recent meeting of the American Society of Civil Engineers, observations upon the temperatures of the earth as shown by deep mines were presented by Messrs. Hamilton Smith, jun., and Edward B. Dorsey. At the new Almaden quicksilver mine at California, at a depth of about 600 ft., the temperature was very high—some 115 deg.—but in the deepest part of the same mine, 1,800 ft. below the surface and 500 ft. below sea-level, the temperature is very pleasant, probably less than 80 deg. At the Eureka mines in California, the air 1,200 ft. below the surface appears nearly as cool as 100 ft. below the surface. Mr. E. B. Dorsey said that the mines on the Comstock vein, Nevada, were exceptionally hot. At depths of 1,500 ft. to 2,000 ft., the thermometer placed in a fresh-drilled hole will show 130 deg. Very large bodies of water have run for years at 155 deg., and smaller bodies at 170 deg. The temperature of the air is kept down to 110 deg. by forcing in fresh air cooled over ice. Captain Wheeler, United States Engineers, estimated the heat extracted annually from the Comstock, by means of the water pumped out and cold air forced in, as equal to that generated by the combustion of 55,560 tons of anthracite coal or 97,700 cords of wood. Observations were then given upon temperature at every 100 ft. in the Forman shaft of the Overman mine, running from 53 deg. at a depth of 100 ft. to 121·2 deg. at a depth of 2,300 ft. The temperature increased:—100 ft. to 1,000 ft. deep, increase 1 deg. in 29 ft.; 100 ft. to 1,800 ft. deep, increase 1 deg. in 30·5 ft.; 100 ft. to 2,300 ft. deep, increase 1 deg. in 32·3 ft. A table was presented giving the temperatures of a large number of deep mines, tunnels, and artesian wells. The two coolest mines or tunnels are in limestone—namely, Chanarcillo mines and Mont Cenis tunnel, and the two hottest are in trachyte and the "coal measures"—viz., the Comstock mines in trachyte and the South Balgray in the "coal measures." Mr. Dorsey considered that experience showed that limestone was the coolest formation.

In reply to numerous letters and communications addressed to the office of Knowledge, *its Editor begs to announce that he has now concluded his Lecturing Tour, and has, in fact, definitely ceased to lecture altogether. Should he (which is very doubtful) at any future time resume his lectures on Astronomy, due and ample notice will be given of such resumption in these columns.*

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

SOLAR GLOW.

[1350]—In connection with Capt. Noble's letter (1344, p. 77), it may be also of interest to mention that the solar glow is a striking object here in the north-west quarter of the heavens on any tolerably clear evening at about an hour and a-half after sunset; and likewise in the north-east before sunrise. The colour of the meteor is not quite white, but seems to be slightly tinged with yellow. R. Phillips.

Northam, Bideford, July 26, 1884.

LIGHTNING—VISIBLE LUMINOUS TRACK OF A METEOR.

[1351]—The record of Thunderstorms which appeared in your issue of 25th instant induces me to send you these few lines, not so much for the purpose of telling you that one passed over my house on July 4 (during which one tree was struck in the front lawn, another within twenty paces of the hall door, and another about a quarter of a mile in the rear), as to remark that, in my humble opinion, the conclusion arrived at some time ago in your columns—that, because the *duration* of a flash of lightning is but about a millionth part of a second, therefore the eye cannot detect its *direction*—is an erroneous one. For not only have I seen lightning descend from the clouds, and dart from cloud to cloud, but also ascend out of the ground; the explanation of which facts, as contrasted with the aforesaid conclusion, appears to me to be very simple, viz., that the electric spark (which, owing to its velocity, appears as a flash) must subtend some angle while passing through the air, which angle is necessarily reproduced in miniature on the retina, the consequence being that the optic nerve conveys to the brain, *in exact sequence*, the impressions made upon its terminal ramifications.

I further wish you would kindly ask your readers whether any of them recollect having observed the track of a meteor remaining visible long after the meteor itself had vanished, as I did on one occasion for about half an hour? Also, can you explain the "quare and quomodo" of such an unusual occurrence? W. A.

July 26, 1884.

[I have myself seen lightning ascend from the earth to a cloud: and hear that this phenomenon was witnessed by a well-known contributor during a heavy storm, on Thursday, the 24th ult.—Ed.]

LIGHTNING.

[1352]—I am surprised that none of your correspondents have referred to the copy of the photograph of a flash of lightning, which appeared in yours of the 4th inst., and which is certainly quite unlike the conventional lightning-flash as it appears in paintings, &c. I only recollect once getting a good side-view of a thunderstorm. I was looking on at a cricket-match in the Phœnix Park, Dublin, and the storm took place in the neighbourhood of Kingstown. It is some years since, but I cannot fix the precise date. I saw a large number of lightning-flashes, all of which strikingly resembled the photograph in question, though in some cases the lines were, I think, a little more wavy In both cases the breadth of the flash was very perceptible, and I should expect to hear that the area of its section was considerable. Nevertheless, when the earth is struck by lightning the surface of contact appears to be very small. Possibly the flashes which I saw and that which was photographed by Mr. Gurley presented exceptional characteristics. Perhaps some of your readers could throw some light on this subject.—I remain, W. H. S. Monck.

13, Belvedere-place, Dublin, July 26, 1884.

PARTRIDGES: THEIR LOVE OF YOUNG.

[1353]—One morning here, after a heavy thunderstorm during the night, accompanied by deluges of rain and a great fall in temperature, the keepers came upon a family of partridges, all dead—the parent birds crouching close together in the grass, their nine little ones between them, pressed as closely as possible to their sides, the inside wing of each parent bird extended, wing over wing, making a double roof for the protection of their family, and in this position these devoted birds had perished, trying to the last to save their young ones at the cost of their own lives. The men who found them seemed quite impressed, and said "It was a pretty picture!" M. J. C.

Swigell House, Northumberland, July 23rd.

OVERHEAD WIRES.

[1354]—Let me say a few words about overhead wires, the danger from which I think may be easily obviated.

At present the posts to which the wires are fastened are placed on the *ridge* of the roof.

Let *additional* posts be placed on the *eave* in the street-front of the building on each side of the street, and directly opposite to each other.

I assume the distance betwixt these posts across the street would be sixty-five feet, and the height of the building and post together from the ground ninety feet. If so, and the wire broke off, *even close* from the post, it would swing twenty-five feet *above the traffic in the street*, and could not, therefore, interfere with it.

The *posts* could be made longer or shorter, so as in all cases a difference of twenty to twenty-five feet should be obtained.

J. W. Busk.

DIVISIBILITY BY SEVEN.

[1355]—When a vulgar fraction whose denominator is 7 is reduced to a decimal fraction, its equivalent is a repetend consisting of six figures, in which, when extended indefinitely, the 7th, 13th, 19th, &c., figures are repetitions of the first, and if the first figure be added to the 4th, 10th, or 16th, &c., figures, the sum is = unity or 9. The 1st figure may, for convenience, be called the complement of the 4th, 10th, or 16th, &c.

Now, if a number be divided into terms of three figures each, and marked 0, 1, 2, 3, &c., from the right, it is evident from the above that any even term divided by 7 will have the same remainder, whether it is taken at its abstract or its local value; also, that any odd term divided by 7 will, taken at abstract value, have a remainder which is the complement of the remainder when the same term is taken at its local value. Take the following example:—

Terms.	2.	1.	0.	
			246,474,585 ÷ 7 =	35,210,655⅔
			or	
Local value	246,000,000	÷ 7 =		35,142,857⅐
,, ...	474,000	÷ 7 =		67,714⅜
,, ...	585	÷ 7 =		83⅐
				35,210,655⅔

Abstract Value.

246 ÷ 7 = 35⅐ true fraction.
474 ÷ 7 = 67⅜ complement of true fraction.
585 ÷ 7 = 83⅐ true fraction.

Taking local values, the remainders are ⅐, ⅜, ⅘, whose sum gives the true fraction. Taking abstract values, the remainders are ⅙, ⅖, ⅘, and the true fraction is to be obtained from them thus, ⅙ − ⅜ + ⅘ = 0; for the same fractional result is obtained whether we add ⅜ to a quantity or subtract ⅜ from it, since the difference between the two results must be (⅜ + ⅜ =) unity. If, therefore, the even terms be called plus and the odd terms minus, and if their sum be divisible by 7 without a remainder, then the whole number is also

so divisible. If there be a remainder, it will either be the true remainder or its complement, according as the sum of the plus terms is greater or less than that of the minus terms.

The extreme left-hand term may consist of less than three figures. WILLIAM SINGERS.

LETTERS RECEIVED AND SHORT ANSWERS.

J. GREEVZ FISHER. Forgive me. I do not "discountenance improvements in spelling because reformers are not unanimous," but because I regard the orthography in which is enshrined the noble diction of Shakespeare, Milton, Pope, Addison, Macaulay, and Tennyson as quite good enough for me. As to the destruction of all traces of the etymology of words by "fonetic vagariz," I need say nothing to any philologist. I am much more disposed to sympathise with you in your protest against the meaningless limitations of the halfpenny postage.—HECTOR. The so-called "storm-glasses" are simply glass tubes (*not* air-tight) filled with a solution of camphor, nitrate of potash, and sal ammoniac. They are hygrometers, if they are anything, but both light and temperature affect them. For any scientific purpose they are worthless.—WM. WILSON, M.A., LL.D. Accepting Colenso's example as one illustrating Common Measure, you are obviously right in what you say as to his definition.—D. WINSTANLEY dreamt on July 8th that his ex-sweetheart came to say "good-bye" on the very morning on which (as he subsequently discovered) she was married to some one else. He also dreamt, on the 14th, a medical man but slightly known to him died on the floor of his (Mr. W.'s) bedroom. This gentleman *did* die, in his own bed, early the next morning. My correspondent goes on to suggest that certain sorts of suppers may "yield prophetic dreams," which is too much for me.—EDWARD F. HOERALE. Without yourself taking the trouble to attend any course of lectures, you will, I think, find in Weinhold's "Introduction of Experimental Physics" ample material for such instruction as you propose to impart; and you might even take the successive chapters of "Facts Around Us"—a little book published by Stanford's—as the basis of a series of lectures to them. I cannot possibly make an appointment for an interview, nor undertake to see any one personally in connection with matters discussed in these columns.—THOMAS MACLEAN. Does it ever strike you that I have scores—not to say hundreds—of correspondents to deal with, and that in the tremendous pressure which exists upon an editor's time, it is quite possible (and even excusable) for him to overlook papers among those which descend in shoals on his devoted head? I have not communicated your notions to Messrs. Browning and Wenham. You must do so yourself if you wish them brought before those gentlemen.—WILLIAM WORSLEY. I do not print the letter on cholera which you send, inasmuch as it contains internal evidence that the "Rev. Dr." who penned it is ignorant of the very rudiments of physiology and pathology.—AN EXILE, while protesting against the selection of Ireland as an illustration of a country sunk in the lowest depths of superstition, points out, not wholly without reason, that past misgovernment may be to some extent held to be at the bottom of such a deplorable state of things.—OXFORD asks this "question": Is it possible to obtain 360 different positions of the letters *a, b, c, d, e, f*, by means of the following two methods of transposition only, (i) $\frac{a, b, c, d, e, f}{a, d, b, f, c, e}$ and (ii) $\frac{a, b, c, d, e, f}{f, d, a, e, b, c}$, the last position being *a, b, c, d, e, f*? We commend this to readers with plenty of idle time on their hands.—EDWARD S. HANSON points out that the "Design for a Parlour Organ," which we extracted from the *Scientific American* on p. 58, was copied from the *Building News* into the *English Mechanic* of March 28 last, and was appropriated by the American paper without any acknowledgment at all. Thanks for your details anent the English translation of Fontenelle.—E. D. WARRING. When a man submits his views for publication, he, *ipso facto*, invites criticism upon them. You surely wanted my candid opinion of yours, and not an utterly insincere compliment.—FRED. JACKMAN. Will you kindly read the paragraph at the bottom of the first column on p. 62, where if is definitely stated that I have given up lecturing altogether?—KEMUS. I am unfortunately unable to give the address of the Cremation Society. Perhaps some reader of KNOWLEDGE will kindly do so.—J. H. HAYWARD. I am, I regret to say, out of town.—ST. E. You can scarcely do better than get the "Human Physiology," by Dr. W. B. Carpenter.—EYE-WITNESS. I do not think that either of my works which you name would render you more assistance than those which you possess. "The Stars in their Seasons" is a reprint of the maps which appeared monthly in Vols. I. and II. of KNOWLEDGE. If you merely want the old constellation figures, get the "Six Star Maps on the Gnomonic Projection," now published by Letts's, but originally issued many years ago by S.D.U.K.

Our Mathematical Column.

EASY LESSONS IN CO-ORDINATE GEOMETRY.

By RICHARD A. PROCTOR.

PROBLEMS ON THE STRAIGHT LINE.

WE proceed to discuss the equations to lines fulfilling given conditions, and also to examine some problems with which it is necessary the student should be familiar.

61. PROP.—*To determine the form of the equation to a straight line passing through a given point.*

Let $x^1\ y^1$ be the co-ordinates of the given point. Now we have already seen that the equation to a straight line passing through $x^1\ y^1$, and inclined at an angle whose tangent is m to the axis of x is

$$y - y^1 = m\ (x - x^1) \qquad \text{(i)}$$

We might have obtained this equation as follows:—Let the equation to the required line be

$$y = mx + c \qquad \text{(ii)}$$

then, since the line passes through the point $x^1\ y^1$, equation (i) must be satisfied when x^1 is written for x, and y^1 for y; therefore

$$y^1 = mx^1 + c \qquad \text{(iii)}$$

And subtracting (iii) from (ii) we clearly obtain equation (i). This amounts to the elimination of c between equations (ii) and (iii). Instead of eliminating c we might have eliminated m; thus, substituting for m in (ii) the value given by equation (iii) we get

$$y = \frac{y^1 - c}{x^1} \cdot x + c$$

this represents a straight line passing through the point $x^1\ y^1$ and having an intercept c on the axis of x.

The equation will clearly assume different forms according to the condition we suppose the straight line to fulfil besides passing through the given point. We shall now consider the equations of lines fulfilling such conditions. It is well to note in passing, however, that whatever form of equation to the straight line be adopted in place of equation (ii), we obtain when the constant term is eliminated by subtraction, an equation of the form

$$x - x^1 + l\ (y - y^1) = 0$$

Thus if in place of (ii) we take the equation

$$\frac{x}{a} + \frac{y}{b} = 1$$

we get in place of (iii)

$$\frac{x^1}{a} + \frac{y^1}{b} = 1$$

or subtracting

$$\frac{x - x^1}{a} + \frac{y - y^1}{b} = 0$$

similarly from the equation

$$x \cos \alpha + y \sin \alpha = p$$

we should obtain

$$(x - x^1) \cos \alpha + (y - y^1) \sin \alpha = 0$$

and finally from the equation

$$\mathrm{A}\ x + \mathrm{B}\ y + \mathrm{C} = 0$$

we should obtain

$$\mathrm{A}\ (x - x^1) + \mathrm{B}\ (y - y^1) = 0.$$

It is important that the student should note these results. They show that in this particular case a relation subsists which we shall presently show to hold generally. The equations

$$x - x^1 = 0, \text{ and } y - y^1 = 0$$

represent lines whose intersection determines the point $x^1\ y^1$, and it appears that the equation formed by combining these two equations into a single equation of the forms

$$x - x^1 + \mathrm{a\ const.}\ (y - y^1) = 0,$$

represents a straight line through the intersection of the lines represented by the two equations so combined.

62. PROP.—*To determine the equation to a straight line passing through two points.*

Let $x_1\ y_1$ be the co-ordinates of one of the given points, $x_2\ y_2$ those of the other. Then it follows from the preceding article that the equation of a straight line through $x_1\ y_1$ is of the form

$$y - y_1 = m\ (x - x_1) \qquad \text{(i)}$$

where m is the tangent of the angle which the straight line makes with the axis of x. If the straight line represented by (i) passes

through the point $x_2\ y_2$ (i) must be satisfied when x_2 is written for x and y_2 for y, thus

$$y_2 - y_1 = m\ (x_2 - x_1)$$

that is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

substituting this value of m in (i) we obtain the required equation, viz.,

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}\ (x - x_1) \qquad \text{(ii)}$$

an equation which may be written in the easily remembered form

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

Cor.—We may write (ii) in the form

$$y(x_2 - x_1) + y_1(x - x_2) + y_2(x_1 - x) = 0 \qquad \text{(iii)}$$

This amounts to the statement that if $x\ y$ be the co-ordinates of any point on the line through x_1y_1 and x_2y_2, then the area of the triangle formed by joining the points x_1y_1, x_2y_2 and $x\ y$ is zero,—a consideration from which we might have deduced the equation required.

Since (iii) may be written

$$x(y_1 - y_2) + y(x_2 - x_1) + x_1y_2 - y_1x_2 = 0$$

the intercepts on the axes of x and y are

$$\frac{x_2y_1 - x_1y_2}{y_1 - y_2} \quad \text{and} \quad \frac{x_2y_1 - x_1y_2}{x_1 - x_2}$$

(*To be continued.*)

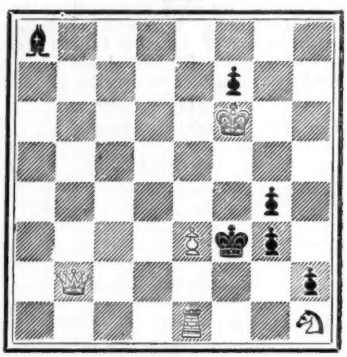
Our Chess Column.

By Mephisto.

SELECTED PROBLEMS.

No. 120.

Black.

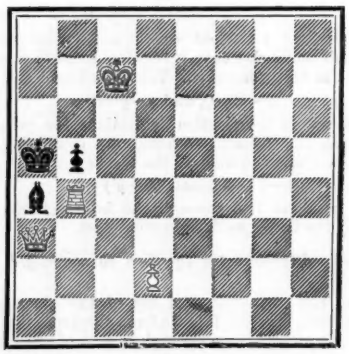


White.

White to play and mate in two moves.

No. 121.

Black.



White.

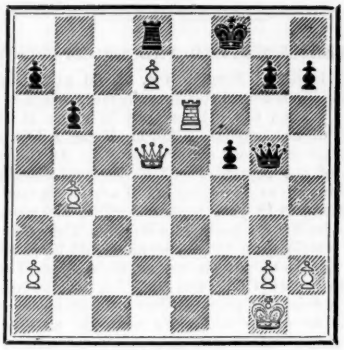
Reprinted from p. 80 on account of misprint.

White to play and mate in two moves.

Ending from actual play.

Amateur.

Black.



White.

Mr. Waters.

White to play and win.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Geo. W. Thompson.—You are quite right; we ought to have published the reply to Black's defence of Kt to Bsq—that is, Kt × P in Carpenter's problem.

E. W. Young.—Regret to say problems not suitable.

W.—You say that you would *cheerfully* have played 50. P × BP in the ending given in Knowledge of July 18, expecting 50. P × RP 51. P to B5, when, I am afraid, on Black playing K to Q4, you would have become rather sad. No doubt we have seen the problem, but cannot recollect it. Is it not unsound?

Walter.—We reprint the position correctly.

Correct solutions received from M. T. Hooton, Chas. T. Wilbraham, G. W. Thompson, Uncle John, C. T. G., The Owl.

The *Norwood Review* says that a new Chess Club in in course of formation; it will assemble in a locality near the station, and will begin in September next.

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